Seafood Risk Assessment

New Zealand Snapper Fishery

Prepared for the OpenSeas Programme

New Zealand Snapper Fishery	Unit/s of Assessment:	
	Product Name/s:	**Snapper**
	Species:	*Chyrsophrys auratus*
	Stock:	SNA1, SNA2, SNA7, SNA8
	Gear type:	Demersal Trawl (SNA1, SNA2, SNA7, SNA8), Demersal Longline (SNA1, SNA2, SNA7), Danish seine (SNA1, SNA8)
	Year of Assessment:	2017

Fishery Overview

This summary is adapted from MPI (2017):

The snapper fishery is one of the largest and most valuable coastal fisheries in New Zealand. The commercial fishery, which began its development in the late 1800s, expanded in the 1970s with increased catches by trawl and Danish seine. Following the introduction of pair trawling in most areas, landings peaked in 1978 at 18 000t. By the mid-1980s catches had declined to 8500–9000 t, and some stocks showed signs of overfishing. With the introduction of the QMS in 1986, TACCs in all Fishstocks were set at levels intended to allow for some stock rebuilding.

New Zealand snapper are thought to comprise either seven or eight biological stocks based on: the location of spawning and nursery grounds; differences in growth rates, age structure and recruitment strength; and the results of tagging studies. These stocks comprise three in SNA 1 (East Northland, Hauraki Gulf and BoP), two in SNA 2 (one of which may be associated with the BoP stock), two in SNA 7 (Marlborough Sounds and Tasman/Golden Bay) and one in SNA 8. Tagging studies reveal that limited mixing occurs between the three SNA 1 biological stocks, with greatest exchange between BoP and Hauraki Gulf.

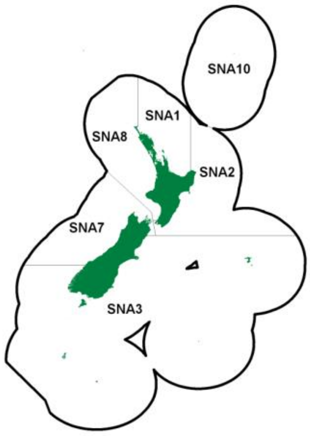


Figure 1: New Zealand snapper quota management areas.

SNA 1 and SNA 8 encompass the main stocks, accounting for 72% and 20% the total commercial catch in 2014-15 respectively (Figure 2). SNA 2 and SNA 7 collectively account for around 8% of the total commercial catch.

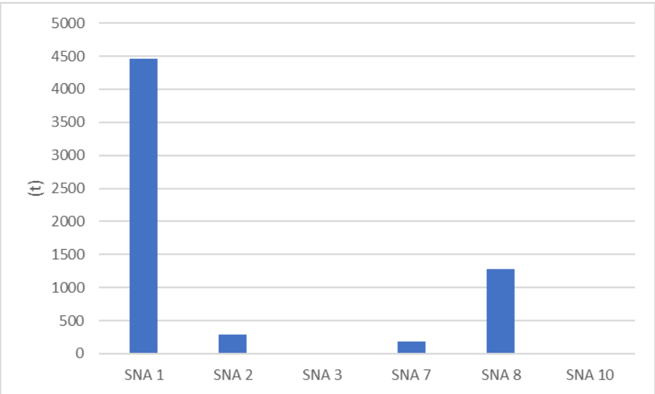


Figure 2: Commercial landings of snapper in New Zealand by quota management area in 2014-15.

Snapper are primarily harvested by trawl and longline gear. Most snapper taken in SNA 1 and 8, and some taken in SNA 7, is the declared target species, but some snapper is taken as a bycatch in a variety of inshore trawl and line fisheries.

The snapper fishery is the largest recreational fishery in New Zealand. It is the major target species on the northeast and northwest coasts of the North Island and is targeted seasonally around the rest of the North Island and the top of the South Island. Recreational catch is larghest in SNA1 where the most recent survey estimated recreational catch at 3,792t in 2011-12 (compared to a commercial catch in the same year of 4,516t). The two main methods used to manage recreational harvests of snapper are minimum legal size limits (MLS) and daily bag limits. Snapper also form important fisheries for customary purposes, but the annual catch is not known.

Units of assessment

Nine separate 'units of assessment' are assessed in this report:

- Demersal trawl – SNA1, SNA2, SNA7, SNA8
- Demersal longline – SNA1, SNA2, SNA7
- Danish seine – SNA1, SNA8

Scoring

Performance Indicator	SNA1 - Trawl	SNA1 - BLL	SNA1 - DS	SNA2 - Trawl	SNA2 - BLL	SNA7 - Trawl	SNA7 - BLL	SNA8 - Trawl	SNA8 - DS
COMPONENT 1									
1A: Stock Status	PHR	PHR	PHR	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH
1B: Harvest Strategy	PHR	PHR	PHR	MEDIUM	MEDIUM	LOW	LOW	PHR	PHR
1C: Information and Assessment	LOW	LOW	LOW	LOW	LOW	MEDIUM	MEDIUM	PHR	PHR
OVERALL	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH
COMPONENT 2									
2A: Non-target Species	PHR	PHR	PHR	PHR	PHR	PHR	PHR	PHR	PHR
2B: ETP Species	PHR	HIGH	LOW	PHR	HIGH	PHR	HIGH	PHR	LOW
2C: Habitats	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
2D: Ecosystems	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
OVERALL	HIGH	HIGH	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM
COMPONENT 3									
3A: Governance and Policy	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
3B: Fishery-specific Management System	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
OVERALL	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW

Summary of main issues

- The SNA1 stock is as likely as not to be below the soft limit.
- The most recent assessment of the SNA8 stock was undertaken in 2005. At that stage, the stock was as likely as not to be below the hard limit, although the stock was projected to rebuild under the current TACC of 1,300t. An updated stock assessment may result in a lower risk score.
- The SNA2 and SNA7 stocks are unlikely to be below the soft limit, and both stocks are projected to grow under current arrangements.
- Observer coverage in inshore fisheries has been very low historically, and very limited information is available on composition and volume of discards.
- The snapper fisheries interact with a number of ETP species. In the bottom longline fishery, the main issue is with black petrels which is the seabird species most at risk from commercial fishing in the most recent risk assessment. In the trawl fisheries, recent risk assessments indicate the extent of estimated captures of seabird species should not hinder recovery, though there is uncertainty over the impact of the fishery on common dolphins. Preliminary results from the New Zealand Marine Mammal Risk Assessment identified common dolphin as the marine mammal species most at risk from commercial fishing.
- The widespread nature of bottom trawling suggests that fishing is the main anthropogenic disturbance agent to the seabed throughout most of New Zealand's EEZ. Recent research suggests moderate and high levels of trawling intensity occur in a relatively small proportion of areas shallower than 200m. The capacity of seabed communities to recover from trawling disturbance is not well known.
- There have been concerns about compliance with quota species retention provisions amongst inshore fisheries.

Outlook

SNA1 – Trawl

Component	Outlook	Comments
Target species	Stable	Stock projections suggest the stock will continue to grow slowly at current catch levels, albeit F may still be above F_{MSY}. Nevertheless, a new draft management plan released in 2016 may accelerate progress.
Environmental impact of fishing	Improving	The information base to examine the ecosystem impacts of inshore trawling is growing. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species. Habitat research is ongoing with new studies planned to better understand the dynamics around impact and recovery. Ecosystem modelling is also underway to better understand the trophic impacts of inshore fishing.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA1 – BLL

Component	Outlook	Comments
Target species	Stable	Stock projections suggest the stock will continue to grow slowly at current catch levels, albeit F may still be above F_{MSY}. Nevertheless, a new draft management plan released in 2016 may accelerate progress.
Environmental impact of fishing	Improving	Estimates of risk to seabird species have been continuously refined over recent years and have generally resulted in lower estimates of overall risk, including to the highest risk species taken in the SNA BLL fishery, black petrel. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA1 – Danish seine

Component	Outlook	Comments
Target species	Stable	Stock projections suggest the stock will continue to grow slowly at current catch levels, albeit F may still be above F_{MSY}. Nevertheless, a new draft management plan released in 2016 may accelerate progress.
Environmental impact of fishing	Improving	The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA2 – Trawl

Component	Outlook	Comments
Target species	Improving	Recent catch levels have been lower than estimates of MSY, which should allow for continued stock recovery.
Environmental impact of fishing	Improving	The information base to examine the ecosystem impacts of inshore trawling is growing. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species. Habitat research is ongoing with new studies planned to better understand the dynamics around impact and recovery. Ecosystem modelling is also underway to better understand the trophic impacts of inshore fishing.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA2 – BLL

Component	Outlook	Comments
Target species	Improving	Recent catch levels have been lower than estimates of MSY, which should allow for continued stock recovery.
Environmental impact of fishing	Improving	Estimates of risk to seabird species have been continuously refined over recent years and have generally resulted in lower estimates of overall risk, including to the highest risk species taken in the SNA BLL fishery, black petrel. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA7 – Trawl

Component	Outlook	Comments
Target species	Improving	Stock projections suggest that spawning biomass is expected to increase over the next 5 years at current TAC levels.
Environmental impact of fishing	Improving	The information base to examine the ecosystem impacts of inshore trawling is growing. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species. Habitat research is ongoing with new studies planned to better understand the dynamics around impact and recovery. Ecosystem modelling is also underway to better understand the trophic impacts of inshore fishing.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA7 – BLL

Component	Outlook	Comments
Target species	Improving	Stock projections suggest that spawning biomass is expected to increase over the next 5 years at current TAC levels.
Environmental impact of fishing	Improving	Estimates of risk to seabird species have been continuously refined over recent years and have generally resulted in lower estimates of overall risk, including to the highest risk species taken in the SNA BLL fishery, black petrel. The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA8 – Trawl

Component	Outlook	Comments
Target species	Improving	Albeit dated (2005), the most recent projections suggest the stock should grow towards BMSY at current catch levels.
Environmental impact of fishing	Improving	The information base to examine the ecosystem impacts of inshore trawling is growing. The introduction of electronic monitoring on the SNA1 fleet should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species. Habitat research is ongoing with new studies planned to better understand the dynamics around impact and recovery. Ecosystem modelling is also underway to better understand the trophic impacts of inshore fishing.
Management system	Stable	No major changes are expected to P3 risk scoring.

SNA8 – Danish seine

Component	Outlook	Comments
Target species	Improving	Albeit dated (2005), the most recent projections suggest the stock should grow towards BMSY at current catch levels.
Environmental impact of fishing	Improving	The introduction of the Integrated Electronic Monitoring and Reporting System (IEMRS) should improve understanding of catch composition and allow more sophisticated assessments of the impact of the fishery on non-target species.
Management system	Stable	No major changes are expected to P3 risk scoring.

Contents

Disclaimer

Background

This report sets out the results of an assessment against a seafood risk assessment procedure, originally developed for Coles Supermarkets Australia by MRAG Asia Pacific. The aim of the procedure is to allow for the rapid screening of uncertified source fisheries to identify major sustainability problems, and to assist seafood buyers in procuring seafood from fisheries that are relatively well-managed and have lower relative risk to the aquatic environment. While it uses elements from the GSSI benchmarked MSC Fishery Standard version 2.0, the framework is not a duplicate of it nor a substitute for it. The methodology used to apply the framework differs substantially from an MSC Certification. Consequently, any claim made about the rating of the fishery based on this assessment should not make any reference to the MSC or any other third party scheme.

This report is a "live" document that will be reviewed and updated on an annual basis.

Methods

Risk Assessment

Detailed methodology for the risk assessment procedure is found in MRAG AP (2015). The following provides a brief summary of the method as it relates to the information provided in this report.

Assessments are undertaken according to a 'unit of assessment' (UoA). The UoA is a combination of three main components: (i) the target species and stock; (ii) the gear type used by the fishery; and (iii) the management system under which the UoA operates.

Each UoA is assessed against three components:

1. Target fish stocks;
2. Environmental impact of fishing; and
3. Management system.

Each component has a number of performance indicators (PIs). In turn, each PI has associated criteria, scoring issues (SIs) and scoring guideposts (SGs). For each UoA, each PI is assigned one of the following scores, according to how well the fishery performs against the SGs:

- Low risk;
- Medium risk;
- Precautionary high risk; or
- High risk

Scores at the PI level are determined by the aggregate of the SI scores. For example, if there are five SIs in a PI and three of them are scored low risk with two medium risk, the overall PI score is low risk. If three are medium risk and two are low risk, the overall PI score is medium risk. If there are an equal number of low risk and medium risk SI scores, the PI is scored medium risk. If any SI scores precautionary high risk, the PI scores precautionary high risk. If any SI scores high risk, the PI scores high risk.

For this assessment, each component has also been given an overall risk score based on the scores of the PIs. Overall risk scores are either low, medium or high. The overall component risk score is low where the majority of PI risk scores are low. The overall risk score is high where any one PI is scored high risk, or two or more PIs score precautionary high risk. The overall risk score is medium for all other combinations (e.g. equal number of medium/low risk PI scores; majority medium PI scores; one PHR score, others low/medium).

Outlook

For each UoA, an assessment of the future 'outlook' is provided against each component. Assessments are essentially a qualitative judgement of the assessor based on the likely future performance of the fishery against the relevant risk assessment criteria over the short to medium term (0-3 years). Assessments are based on the available information for the UoA and take into account any known management changes. Outlook scores are provided for information only and do not influence current or future risk scoring.

Table 1: Outlook scoring categories.

Outlook score	Guidance
Improving	The performance of the UoA is expected to improve against the relevant risk assessment criteria.
Stable	The performance of the UoA is expected to remain generally stable against the relevant risk assessment criteria.
Uncertain	The likely performance of the UoA against the relevant risk assessment criteria is uncertain.
Declining	The performance of the UoA is expected to decline against the relevant risk assessment criteria.

Information sources

Information to support scoring is obtained from publicly available sources, unless otherwise specified. Scores will be assigned on the basis of the objective evidence available to the assessor. A brief justification is provided to accompany the score for each PI.

Assessors will gather publicly available information as necessary to complete or update a PI. Information sources may include information gathered from the internet, fishery management agencies, scientific organisations or other sources.

Assessment Results

COMPONENT 1: Target fish stocks

1A: Stock Status

CRITERIA: (i)The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.

(a) Stock Status

SNA1 **PRECAUTIONARY HIGH RISK**

In 2013, a fully quantitative spatially disaggregated stock assessment model that incorporates three separate stocks was used to assess the status of the SNA 1 Quota Management Area (QMA) (Francis and McKenzie, 2015). This model took into account recreational and commercial catch history, abundance estimates from catch-per-unit-effort (CPUE) analysis, abundance and mixing estimates from tagging programmes and research trawl surveys, and catch at age information from sampling of the commercial fishery.

The 2013 base case assessments predicted both the East Northland and Hauraki Gulf stocks to be at 24% B_0 in the 2012–13 fishing year; thus above the soft limit of 20% B_0 but below the target of 40% B_0. The Bay of Plenty stock was predicted to be at 6% B_0 in 2013 i.e., below the hard limit of 10% B_0. The combined status of the Hauraki Gulf and Bay of Plenty stocks in 2013 was 19% B_0 (Francis and McKenzie, 2015) (Table 2).

If it is assumed that the Hauraki Gulf and Bay of Plenty stocks form a combined sub-stock (see discussion in Francis and McKenzie, 2015), this sub-stock accounts for over 80% of the estimated SNA 1 biomass.

Table 2: Base model estimates of unfished biomass (B_0) and 2013 biomass (B_{2013} as $\%B_0$) by stock. ENLD=East Northland; HAGU=Hauraki Gulf; BOP=Bay of Plenty; HAGUBOP=combined Hauraki Gulf/Bay of Plenty stock. Estimates are MCMC medians with 95% confidence intervals in parentheses. (from Francis and McKenzie, 2015)

	B_0 ('000 t)	B_{2013} ($\%B_0$)
By stock		
ENLD	66 (53, 79)	24 (18, 30)
HAGU	220 (192, 246)	24 (19, 29)
BOP	86 (63, 112)	6 (3, 9)
HAGUBOP	306 (288, 325)	19 (15, 23)

MPI (2017) concluded that both sub-stocks were 'Very Unlikely' (less than 10% probability) to be at or above the interim 40% B_0 target, and 'About as Likely as Not' (40% to 60% probability) to be below the soft limit (20% B_0). The probable position of biomass in 2013 against target and limit reference points is outlined in Table 3.

Table 3: Probability relating 2013 biomass to the limit, soft and target reference points. (MPI, 2013a)

	East Northland	Hauraki Gulf–Bay of Plenty
At or above target (40% B_0)	0.00	0.00
Below soft limit (20% B_0)	0.12	0.74
Below hard limit (10% B_0)	0.00	0.00

Five-year projections carried out under "status quo" conditions (taken to mean constant catches [equal to the 2012 and 2013 catches] for the commercial fisheries and constant exploitation rate [equal to the average of the 2008‐2012 rates] for the recreational fisheries), predicted increasing or near-stable biomass for all stocks if future recruitment was similar to that between 1996 and 2005 (i.e. above average) (Francis and McKenzie, 2015). However, all stocks were predicted to decline between 2013 and 2018 if recruitment was assumed to be around the long term average. In either case, current catches did not result in the stock rebuilding to the target reference point (40%B_0).

The medium risk scoring guidepost against this performance indicator requires that it is "likely that the stock is above the point where recruitment would be impaired (PRI)". The MSC Certification Requirements V2.0 sets a default PRI level of 20% B_0 and defines 'likely' in a probabilistic context, requiring that there be at least a 70% probability that the scoring guidepost is met. In the case of SNA 1, it was likely (74%) that the main Hauraki Gulf/Bay of Plenty stock was below 20% B_0 in 2013 and overall MPI (2017) still conclude it is as likely as not that both stocks are below the 20% B_0 soft limit. On this basis, the medium risk scoring guidepost is not met. Nevertheless, on the basis that stocks appear to be in the region of the soft limit, deterministic estimates which indicate MSY is likely to be lower than 40% B_0 (around 25-30% B_0) (Francis and McKenzie, 2015), we have scored this SI precautionary high risk.

SNA2 MEDIUM RISK

A stock assessment of SNA2 was conducted using a statistical, age-structured population model implemented in Stock Synthesis (Langley, 2010). The model encompasses the 1933–2009 period and incorporates seven years of catch-at-age data sampled from the commercial fishery (between 1991–92 and 2007– 08) and a standardised CPUE index for the bottom trawl fishery for the recent period (1989–90 to 2007–08). Two alternative values of natural mortality were considered (0.075 and 0.06) and due to a paucity of data it assumed an externally derived selectivity function.

The model indicated that the fishery was fished to approximately 5% virgin biomass in the 1980s but has since recovered. However, the two estimates of natural mortality provided very different estimates of relative 2009 biomass, with M=0.075 being 26.3% B_0 and M=0.06 being 11.6% B_0 (Figure 3). MPI (2017) concludes that there is a >60% probability that the stock is above the soft limit and the broad range of ages present in the catch suggests that the stock is unlikely to be at very low levels.

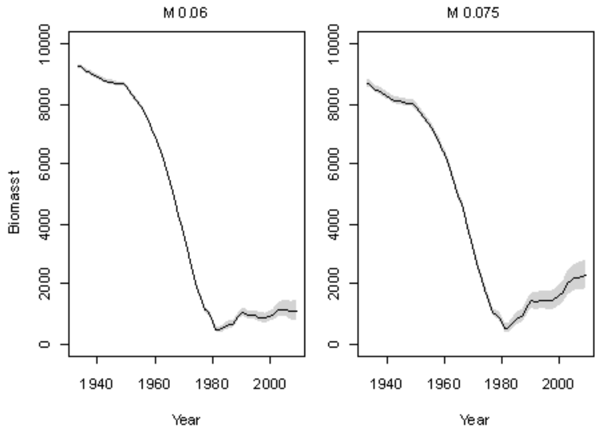


Figure 3: Biomass (median and 90 percentiles of the posterior distribution) for SNA 2 with the alternative assumptions of lower (0.06) and higher (0.075) natural mortality. Biomass is defined as mature, female biomass. (MPI, 2017)

In relation to fishing mortality, MPI (2017) note that "*for the range of model runs investigated, estimates of MSY (443– 496 t) were higher than the recent catch levels (376 t). By inference, the stock biomass would be expected to have increased slowly over the last decade if recruitment has been maintained at or above long term average levels*".

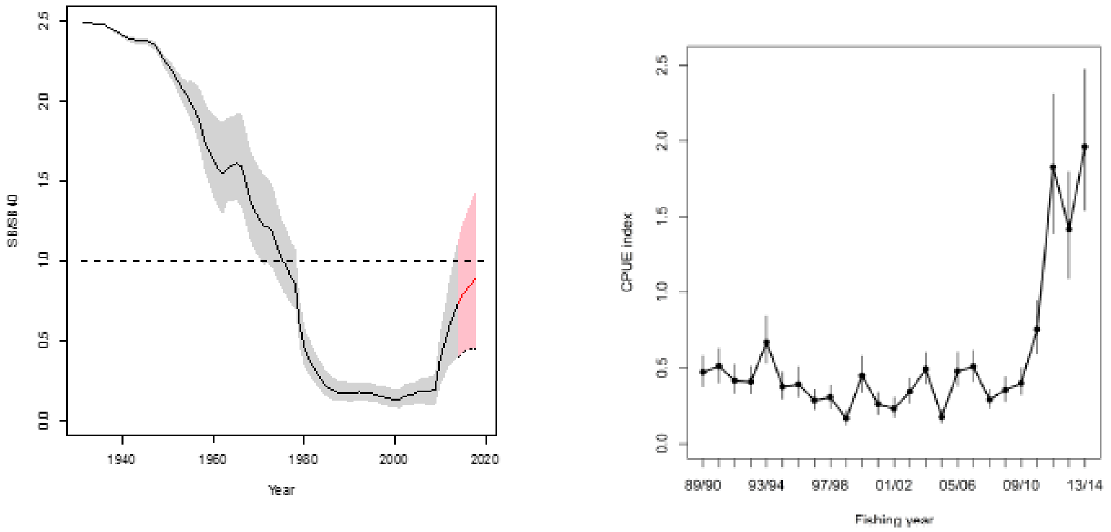
Overall, they conclude that it is unlikely (<40%) that the stock is below the soft limit. Although this does not align completely with the MSC benchmark of >70% probability of being above the default PRI given the 60% probability estimate that the stock is above B_{20}, the broad range of ages present in the catch and indications that current catches are less than MSY, we have scored this SI medium risk on the basis that it is probably likely that recruitment is not impaired. Any updated assessments providing additional certainty around stock sizes should be taken into account in future assessments.

SNA7 MEDIUM RISK

The 2015 stock assessment for snapper in SNA7 estimated $B_{2014\text{-}15}$ to be 29% B_0. MPI (2017) conclude the stock is very unlikely (< 10%) to be at or above the target (B_{40}) and also unlikely (<40%) to be below B_{20}.

Figure 4(a) shows the stock biomass trajectory from for the SNA7 stock from 1931 to 2014-5. The stock declined substantially from the 1930s to the early 1980s, before stabilising and recovering rapidly from around 2010 to be almost three times the level at its lowest point. Catch rates have also substantially increased in recent years, with catch rate in 2014-5 being around four times the average rate from 1989/90 to 2009/10 (Figure 4b).

Although MPI's (2017) stock status classification alone is not sufficient to meet the MSC's 70% probability benchmark for being 'likely' to be above PRI, in practice the probability sits somewhere between 60% and 90% likelihood of being above B_{20}. This, together with the recovery of the stock from low levels and the positive trend in recent catch rates, is evidence that the stock is likely to be above PRI. There is less evidence however that the stock is yet fluctuating at or around levels consistent with MSY, and on this basis, the stock is scored medium risk.



(a) *(b)*

Figure 4: (a) Annual trend in spawning biomass relative to the 40% SB_0 interim target biomass level for the base model. The line represents the median and the shaded area represents the 95% confidence interval. The projection period (2014-2018) is in red. The dashed line represents the interim target level; (b) standardised CPUE from a combined single trawl fishery in the SNA 7 area (MPI, 2017)

SNA8	**HIGH RISK**

The most recent assessment was undertaken in 2004 using CASAL (Bull et al. 2004). It was age-based but included approximations for length-based selectivities. The assessment models the SNA 8 exploitation history by maximising the likelihood fit to a time series of observations (MPI, 2017).

Virgin stock biomass (B_0) was defined as that resulting from mean recruitment and the 1975-79 mean weights-at-age and is equal to the modelled 1931 biomass. In 2005, model estimates of current biomass were very low, being B_{2005}/B_0=9.8% or B_{2005}/B_0=10% for recreational catches of 300 t or 600 t, respectively.

The 2017 Plenary concluded that the stock was 'Very Likely (> 90%)' to be below (in 2005) the soft limit of B_{20}, and as likely as not to be below the hard limit of 10% (MPI, 2017). Based on these model outputs, and the absence of assessments since, there is limited evidence the stock is above the PRI and is scored high risk.

Notwithstanding that, we note that B_{MSY} for the SNA 8 stock has been analytically determined to be below 40%B_0. MPI (2017) report that if a constant mean size-at-age equal to that for 1931‑2004 was used, the 2005 stock assessment estimated B_{MSY} = 18.3% B_0. Alternatively, if the 1989‑2004 mean size-at-age were used, B_{MSY} = 17.5% B_0. Based on exploratory modelling of density-dependent growth, the Working Group adopted 20% B_0 as the definition for B_{MSY}. Future assessments against this framework should take into account the outcomes of any new stock assessments in the context of B_{MSY} estimates.

PI SCORE	**MEDIUM RISK – SNA2, SNA7**
	PRECAUTIONARY HIGH RISK – SNA1
	HIGH RISK – SNA8

1B: Harvest Strategy

CRITERIA: (i) There is a robust and precautionary harvest strategy in place.

(a) Harvest Strategy

The fundamentals of the harvest strategy are similar across each of the snapper stocks. The principal harvest control on the commercial sector is through the application of TACCs and ITQs under the Quota Management System (QMS). Entry into the harvesting sector of the fishery is not limited, although harvesters must operate within the compliance regime and acquire sufficient Annual Catch Entitlement (ACE) (an annually renewable catch entitlement linked to ITQs) to cover all catches. An escalating monetary penalty referred to as a 'deemed value' must be paid for all catches unable to be covered by ACE. Additional controls also exist through gear restrictions, minimum legal sizes (MLS) and spatial closures under both fisheries and environmental legislation. Catches are monitored through compulsory logbooks and catch returns. Some vessels are monitored through VMS.

The main controls on the recreational sector are through bag limits, minimum legal sizes (MLSs) and spatial closures. Limits are also applied to the number of hooks a fisher can use. Recreational catches are estimated through comparatively sophisticated survey techniques which vary by QMA. In SNA 1, for example, catches are estimated using 'aerial access surveys' "which combines data collected concurrently from two sources - a dawn-to-dusk survey of recreational fishers returning to a sub-sample of boat ramps throughout the day; and a concurrent area-wide aerial count of vessels observed to be fishing at the approximate time of peak fishing effort on the day" (MPI, 2017), and also national surveys.

TACs and TACCs are set according to the NZ Harvest Strategy Standard which establishes default target (25% - 45% B_0, depending on the productivity of the stock), soft limit (20% B_0) and hard limit (10% B_0) reference points which guide Ministry advice to the Minister (MFish, 2008; MFish, 2011). Under the Standard, TACs are set at levels that aim to maintain biomass at levels consistent with the Target Reference Point (TRP), a breach of the soft limit triggers a requirement for a formal, time-constrained rebuilding plan and a breach of the hard limits leads to consideration for closure.

Management objectives for the harvest strategy are guided by the Fisheries 2030 Management goals. Periodic review of stock status and recommended TAC levels occurs through the MPI Working Group process.

SNA1 **PRECAUTIONARY HIGH RISK**

Harvest controls for both the commercial and recreational sector in SNA 1 have been refined in response to the state of the stock. In 1997, in response to negative stock trends the TACC for SNA 1 was reduced from 4938t to 4500t within an overall TAC of 7550t. More recently, management controls on SNA 1 were subject to intensive review (MPI, 2013a), which ultimately resulted in an increase in the TAC to 8050t (while the TACC was maintained at 4500t). In the recreational sector, bag limits were reduced from 30 to 20 in 1993, to 15 in 1994, to 9 in 1995 and more recently to 7 in 2014 (MPI, 2017). The MLS was increased from 25cm to 27cm in 1994 and to 30cm in 2014. The recreational allowance in the TAC was increased from 2550t to 3050t in 2014.

Collectively these changes have reversed the decline in spawning biomass evident to around 1985-1990 (Figure 5), and are expected to result in slow growth in biomass assuming recent average levels of recruitment (MPI, 2017).

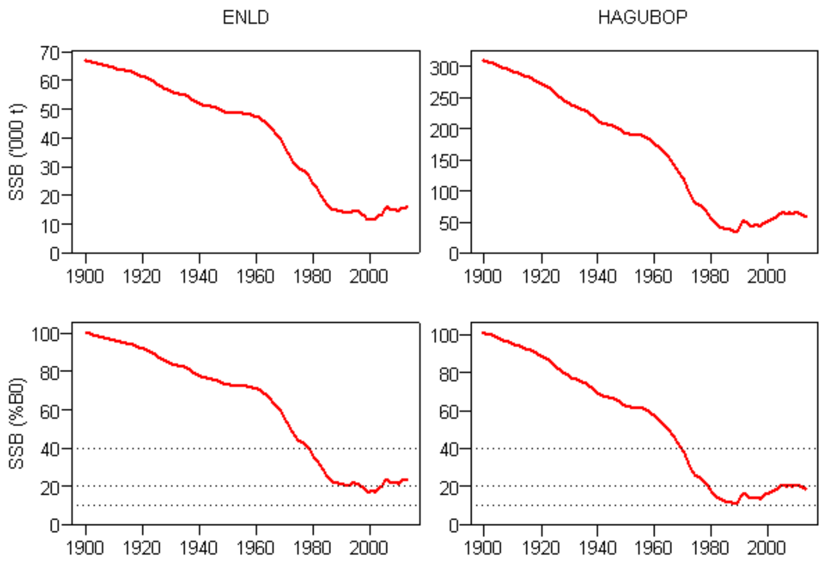


Figure 5: SNA 1 historical stock status and current status. Dotted lines indicate interim target (40%B0), soft limit (20%B0) and hard limit (10%B0). (MPI, 2017)

A large suite of spatial and gear based restrictions also apply to SNA 1 (Figure 6).

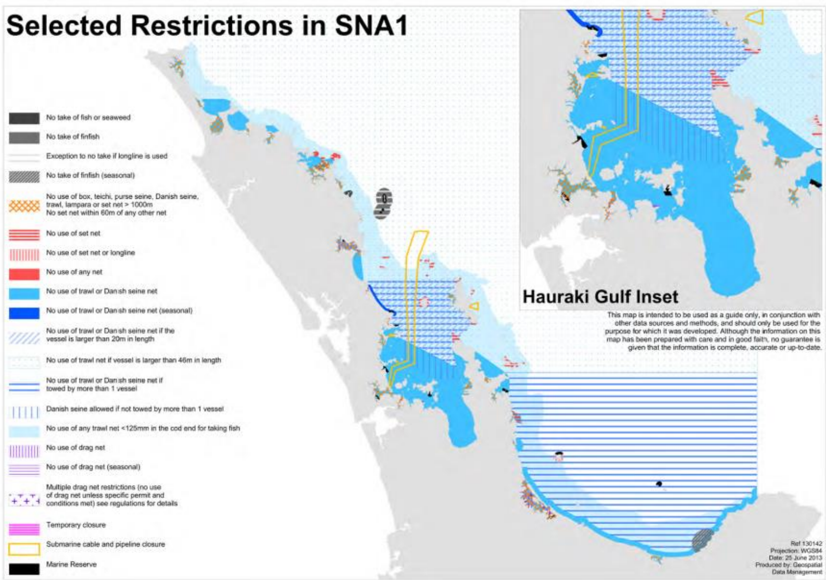


Figure 6: Spatial management restrictions in SNA 1 (MPI, 2013b)

Overall, the harvest strategy appears responsive to the state of the stock, and all of the elements appear to have worked together to recover the stocks from slightly below to around the soft limit. Moreover, based on the available evidence, it appears that the current harvest strategy arrangements will continue to result in a slow rebuilding of biomass above the default B_{20} soft limit (MPI, 2017). However, estimates of $F_{current}$ under the current arrangements appear to be higher than F_{MSY} and MPI (2017) conclude that "current catch is very likely (> 90%) to cause overfishing to continue" for both main stocks and that overall "overfishing is likely (> 60%) to be occurring" on both stocks. Results from the deterministic B_{MSY} calculations were used to determine the level of fishing that would maintain the spawning biomass at the interim target level of 40%B_0. This ranged from 19% to 59% of the 2013 level. Nevertheless, MPI (2017) also note that current catch levels are very unlikely (<10%) to result in the East Northland stock falling below the B_{20} soft limit, and unlikely (<40%) to result in the Hauraki Gulf + Bay of Plenty stock falling below the B_{20} soft limit.

In order to achieve SG60 under MSC CR 2.0 (equivalent to the medium risk SG here), the harvest strategy must be expected to achieve the stock management objectives reflected in PI1.1.1 SG80. These are that (a) it is highly likely that the stock is above the PRI and (b) the stock is at or fluctuating around a level consistent with MSY. Based on current levels of fishing mortality it appears unlikely that the stock will recover to the interim 'default' MSY reference point of 40% B_0 in the short-medium term (i.e. MPI conclude it is very likely that current catches will cause overfishing to occur). This issue is complicated by deterministic estimates which suggest B_{MSY} may be lower than 40% B_0, and anecdotal reports which suggest that the stock is likely to be in reasonable shape (e.g. MPI, 2013a). The possibility that B_{MSY} may be lower than 40% B_0 is acknowledged by MPI who suggest that a likely long term target reference point will be between 33% and 40% of B_0 (MPI, 2013a). On the basis that the current harvest strategy appears unlikely to return biomass to its interim target reference level, but is also at least unlikely to result in the stock falling below 20% B_0, we have scored this SI precautionary high risk.

Importantly, a new draft management plan for SNA1 has recently been released for public comment (SNA1SG, 2016). The plan aims to achieve a biomass target of 40% of the unfished state within 25 years (by 2040), with an intermediate milestone of 30% of the unfished biomass level achieved within 10 years (by 2025). The plan sets out a range of catch management (e.g. TAC setting, allocation, MLS), monitoring and research (e.g. MSE, fishery-independent monitoring, etc) and education/outreach measures to support its objectives. Future scoring of this SI should consider the extent to which the measures recommended under the plan have been implemented and are successful.

SNA2	**MEDIUM RISK**

MPI (2017) reports that in SNA 2, the bycatch of snapper in the tarakihi, gurnard and other fisheries resulted in overruns of the snapper TACC in all years from 1987–88 up to 2000–01. From 1 October 2002, the TACC for SNA 2 was increased from 252 to 315 t, within a total TAC of 450 t. Although the 315 t TACC was substantially over-caught from 2002–03 to 2006–07, catches have since been closer to the TACC (MPI, 2017).

Additional restrictions have been applied to the recreational sector over time including reducing bag limits from 30 to 10 in 2005, and increasing the MLS from 25 to 27cm in 2005. Recreational catch has most recently been estimated using a panel survey in 2011-12 (MPI, 2017).

Notwithstanding the uncertainty in the most recent (2010) model outputs, MPI (2017) note that "*for the range of model runs investigated, estimates of MSY (443–496 t) are higher than the recent catch levels (376 t). By inference, the stock biomass would be expected to have increased slowly over the last decade if recruitment has been maintained at or above long term average levels*." They conclude that it is unlikely (>40%) that the stock will fall below the soft limit (20% B_0) within the next 5 years, although there is no estimate of current status in relation to the target reference point. On the basis that current catch is likely to be below MSY and that, all other things being equal, biomass should increase over time to B_{MSY} under current arrangements, we have scored this SI medium risk. If greater certainty is achieved in the stock assessment and evidence becomes available that biomass is likely to recover to MSY under the existing harvest strategy, this indicator may score low risk.

SNA7	**LOW RISK**

The 2015 stock assessment for snapper in SNA7 estimated $B_{2014\text{-}15}$ to be 29% B_0. Biomass has trended upward since around 2000 (Figure 4), although this appears largely the result of one or two strong year classes (MPI, 2017). The TACC was reduced in 1989 from 372t to 151t, but was raised again in 1990 and 1997 to 160t and 200t respectively. The 30 fish recreational bag limit introduced in 1985 was reduced to 10 outside the Marlborough Sounds and 3 inside the Sounds in 2005. Actual fishing mortality has declined steadily since 2006.

Stock projections suggest that spawning biomass is expected to increase over the next 5 years assuming current (2013–14) catch levels, although the extent of the increase is dependent on the magnitude of the estimates of recent recruitment (2007 and/or 2008 year classes) (MPI, 2017). MPI (2017) conclude that it is very unlikely (<10%) that current levels of F will result in overfishing and that it is very unlikely that the stock will fall below the soft limit. Based on recent positive stock trends, an increase in the TAC by 239 tonnes from 306 tonnes to 545 tonnes has recently been approved (Guy, 2016). Model projections suggest with a high degree of certainty that a TAC of 545 tonnes can be supported while the stock continues to rebuild toward target levels, at which point the fishery is estimated to support 600 to 800 tonnes of catch per year.

Based on stock projections showing the stock is likely to fluctuate at or around B_{MSY}, there is a reasonable basis to conclude that the harvest strategy is responsive to the state of the stock and all of the elements are working together to achieve the stock management objectives reflected in criteria 1A(i). Accordingly, we have scored this SI low risk.

SNA8	**PRECAUTIONARY HIGH RISK**

The 2005 stock assessment indicated that current biomass (start of year 2004–05) was between 8% and 12% B_0 and the biomass was predicted to slowly increase at the TACC level of 1500 t (MPI, 2017). However, from 1 October 2005 the TACC was reduced to 1300 t to ensure a faster rebuild of the stock. At this TACC, the predicted rebuild to B_{MSY} (20% B_0) occurred after 2018 in all cases assuming either constant recreational effort, or capped recreational catch at the alternative levels of 300 t or 600 t per year. Rebuilding tended to be slower for runs that allowed the recreational catch to rise with increasing biomass.

The scoring of this SI is complicated by the absence of a recent stock assessment. In general, the harvest strategy has been responsive to the state of the stock (in that both TACCs and recreational bag limits and MLSs have been adjusted progressively over time to move the stock towards B_{MSY} levels) and stock projections from 2005 suggest that at the current TACC of 1300t, rebuilding should be occurring. Nevertheless, there is little recent information to confirm stock sizes and MPI (2017) indicate that recent catch-at-age sampling shows that the age structure in the fishery has changed little over the last 20 years (averaging around 6 years – the lowest of all the snapper stocks). They also report that the current age structure makes the stock very vulnerable to recruitment failure extending more than 2-3 years in duration. Accordingly, while it is possible the current harvest strategy will achieve the stock management objectives reflected in criteria 1A(i), this is not known with any confidence and we have scored this SI precautionary high risk. A more recent stock assessment may result in this SI achieving a lower risk score.

(b) Shark-finning

NA

CRITERIA: (ii) There are well defined and effective harvest control rules (HCRs) and tools in place.

(a) HCR Design and application

All stocks **LOW RISK**

The commercial component of New Zealand's snapper fisheries is managed as part of the NZ Quota Management System (QMS) which has very strong mechanisms to reduce the exploitation rate where evidence exists that the PRI is being reached, and there is good evidence to indicate that such mechanisms have been used in other fisheries (e.g. hoki). Moreover, all QMS fisheries are subject to the NZ Harvest Strategy Standard which establishes default target, soft limit and hard limit references points which guide TACC setting and Ministry advice to the Minister (MFish, 2008).

While there is no mathematical function which dictates the setting of the TAC according to its position against reference points for any of the SNA stocks at present, the harvest strategy standard requires the implementing of a rebuilding plan if the stock is assessed to be below the soft limit, and considering the fishery for closure if the stock is below the hard limit. Together with future stock projections under different TAC scenarios and advice provided by MPI to the Minister in relation to his obligations under the HSS and Fisheries Act, these have been interpreted in full MSC assessments for other NZ fisheries (e.g. hoki, ling) to meet at least the SG80 scoring guideline. To that extent, we have scored the fishery low risk here. Nevertheless, the fishery would be better placed against the MSC standard with additional clarity around how exploitation rate will be reduced as the PRI is approached.

PI SCORE	**LOW RISK –SNA7**
	MEDIUM RISK – SNA2
	PRECAUTIONARY HIGH RISK - SNA1, SNA8

1C: Information and Assessment

CRITERIA: (i) Relevant information is collected to support the harvest strategy.

(a) Range of information

All stocks **LOW RISK**

Notwithstanding some uncertainties in relation to stock structure and productivity, each of the snapper stocks is comparatively very well-studied and sufficient information is available to support the harvest strategy. The available information on stock structure and productivity is summarised in MPI (2013a) and MPI (2017). Very good monitoring of catch, effort and fleet composition in the commercial sector exists through logbooks, QMS documentation, VMS and (to a lesser extent) independent observers. In the recreational sector, information on fleet composition is available through aerial access surveys (SNA 1) and national panel surveys (other QMAs). Less monitoring of customary fishing occurs although catches in the sector are small in comparison to commercial and recreational catches.

(b) Monitoring and comprehensiveness

SNA1, SNA2, SNA7 **LOW RISK**

UoA removals in the commercial sector are closely monitored through the QMS reporting arrangements, while in the recreational sector catches are monitored through independent surveys (e.g. aerial access and national panel surveys in SNA 1 in 2011-2; national panel surveys in other QMAs in 2011-2) (MPI, 2017). Stock abundance is monitored through periodic quantitative stock assessments, as well as through other indicators of stock health (e.g. fish size and age, standardised commercial CPUE, etc). Monitoring arrangements are summarised in MPI (2017).

SNA8 **PRECAUTIONARY HIGH RISK**

UoA removals in the commercial sector are closely monitored through the QMS reporting arrangements, while in the recreational sector catches are monitored through independent surveys (e.g. aerial access and national panel surveys in SNA 1 in 2011-2; national panel surveys in other QMAs in 2011-2) (MPI, 2017). Nevertheless, stock abundance has not been monitored with the same frequency as other SNA stocks with the most recent assessment undertaken in 2005. While catch-at-age sampling has reportedly occurred in the meantime (MPI, 2017), it is not clear from the publicly available information that abundance has been monitored with sufficient frequency to support the harvest control rule. Nevertheless, the 2005 assessment projected that under the current TACC of 1300t the stock would increase, reaching B_{MSY} (20% B_0) after 2018 under all scenarios modelled. Accordingly, we have scored this SI precautionary high risk.

CRITERIA: (ii) There is an adequate assessment of the stock status.

(a) Stock assessment

SNA1 **LOW RISK**

Francis and McKenize (2015) report that "the base model is a development of the three-stock, three-area model used in the 2012 assessment (Francis & McKenzie 2015). The Francis & McKenzie model recognises SNA 1 as being comprised of three separate stocks and uses a home fidelity (HF) dynamic to model movement of these stocks between three spatial areas: East Northland, Hauraki Gulf; Bay of Plenty." The model was written using CASAL (Bull et al 2012) and partitions the modelled population by age (ages 1‑20+), stock (three stocks), area (the three subareas), and tag status (grouping fish into six categories – one for untagged fish, and one each for each of five tag release episodes). The model covered the time period from 1900 to 2013, with two time steps in each year. MPI (2017) give the assessment an overall quality rating of '1', the highest on a four point scale.

The assessment is appropriate for the stock and estimates stock status relative to reference points which are appropriate for the stock (albeit the B_{40} TRP is an 'interim' target and a long term target is expected to be developed with stakeholders shortly) and can be estimated.

SNA2 **MEDIUM RISK**

A stock assessment for SNA 2 was conducted in 2009 (Langley 2010), following earlier assessments by Harley & Gilbert (2000) and Gilbert & Phillips (2003). The 2009 assessment used a statistical, age-structured population model implemented using the Stock Synthesis software (Methot 2009; in MPI, 2017). The model encompasses the 1933–2009 period. The model structure includes two sexes, 1–19 year age classes, and an accumulating age class for older fish (20+ years). The age structure of the population at the start of the model is assumed to be in an unexploited, equilibrium state. Model uncertainty was estimated using a Markov chain Monte Carlo (MCMC) approach.

MPI (2017) concluded that there is a high level of uncertainty associated with the assessment, with the result that stock status and projections cannot be reliably determined. However, estimates of *MSY* were robust to the range of assumptions investigated but are dependent on the assumptions regarding historical catch. For the range of model scenarios considered, estimates of *MSY* were higher than the recent and current levels of catch. On the basis that the assessment estimates stock status relative to generic reference points appropriate to the species category we have scored this SI medium risk.

SNA7 **LOW RISK**

A statistical age structured population model for SNA 7 was implemented using Stock Synthesis (Methot & Wetzell 2013; in MPI, 2017). The main structural assumptions for the base model option are outlined in MPI (2017). Model uncertainty was estimated using MCMC (sampling from 1 million MCMC draws at an interval of 1000).

MPI (2017) noted that "*the development of a time-series of CPUE indices from the SNA 7 trawl fishery (Hartill & Sutton, 2011) has enabled a new stock assessment to be conducted*." They also reported that the results of a preliminary assessment were accepted by the 2014 Plenary, "*although a range of issues were identified that required further development. These issues included the incorporation of recent (2013–14) age composition data, an update of the CPUE indices, restructure of commercial catch history by fishing method, and reviews of historical age composition data and the 1987 tag biomass estimate. Each of these issues was addressed in the intervening period and the 2015 the stock assessment model was refined and updated accordingly (Langley in prep.)*". MPI (2017) give the assessment the highest overall quality rating of '1'. The current model estimates status relative to reference points which are appropriate to the stock and can be estimated. Accordingly, we have scored this SI low risk.

SNA8 **MEDIUM RISK**

The most recent stock assessment for SNA 8 was undertaken in 2005 (MPI, 2017). MPI (2017) report that "*the assessment model was written using CASAL (Bull et al 2004). It was age-based but included approximations for length-based selectivities. It models the SNA 8 exploitation history by maximising the likelihood fit to a time series of observations. Bayesian estimates for the fitted parameters were the means of the estimated marginal posterior distributions; priors were specified for key model parameters such as R0 (mean recruitment), q (catchability coefficient), selectivity at length, natural mortality and year class strengths. For particular types of observations the model incorporates process error as defined by Bull et al (2004). Stochastic projections of the model to 2025 were undertaken to assess the probability of population increase and the decline in annual harvest proportions under alternative future catch levels*." Model assumptions are described in MPI (2017).

While the assessment estimates status relative to reference points which are appropriate to the stock and can be estimated, the degree to which it remains current is unclear given its age. To that end, we have scored this SI medium risk. It is not unknown when the next assessment will be undertaken (MPI, 2017).

(b) Uncertainty and Peer review

SNA1 **LOW RISK**

The 2013 assessment took uncertainty into account by producing a base case and multiple alternative models to determine the sensitivity of the assessment to various model assumptions (Francis & McKenzie 2015b; in MPI, 2017). The assessment is subject to peer review through the MPI Working Group process.

SNA2 **MEDIUM RISK**

The 2010 assessment examined the effects of uncertainty through preliminary model runs using alternative assumptions (e.g. for selectivity). MPI (2017) report "model results, particularly current stock status, are highly dependent on the selectivity function applied and, consequently, should be considered very uncertain. The model results were also highly sensitive to the relative weighting assigned the CPUE indices and the age frequency data. For this reason, the estimates of current stock status from the model are not reported. Nonetheless, other model stock indicators (particularly estimates of *MSY*) were less sensitive to the selectivity assumption and the model is likely to be more informative regarding estimates of yield."

Given reliable biomass estimates were not able to be produced, we have scored this SI medium risk. Nevertheless, we note the assessment has highlighted – and attempted to take into account – uncertainties and has been peer reviewed through the MPI Working Group process.

SNA7	**LOW RISK**

MPI (2017) note the 2015 assessment has addressed the uncertainties in the preliminary assessment accepted by the working group in 2014, and is subject to peer review through the MPI Working Group process. Accordingly, we have scored it low risk.

SNA8	**MEDIUM RISK**

The main uncertainties in the 2005 model are identified in MPI (2017) and include:

- "*the tagging estimates may be biased;*
- *the MPD residuals are not consistent with the statistical assumptions of the model because extra weight was given to the tagging estimates;*
- *natural mortality is not known exactly (as was assumed in the MCMCs);*
- *the catch history is uncertain with regard to Japanese longline catch and commercial catch overruns in addition to recreational catch*."

Given the model has not been run since 2005 these uncertainties have not been taken into account. Accordingly, we have scored this SI medium risk.

PI SCORE	**LOW RISK – SNA1, SNA7**
	MEDIUM RISK – SNA2
	PRECAUTIONARY HIGH RISK – SNA8

COMPONENT 2: Environmental impact of fishing

2A: Other Species

CRITERIA: (i) The UoA aims to maintain other species above the point where recruitment would be impaired (PRI) and does not hinder recovery of other species if they are below the PRI.

(a) Main other species stock status

The intent of this scoring issue is to examine the impact of the UoA on 'main' other species taken while harvesting the target species. 'Main' is defined as any species which comprises >5% of the total catch (retained species + discards) by weight in the UoA, or >2% if it is a 'less resilient' species. The aim is to maintain other species above the point where recruitment would be impaired and ensure that, for species below PRI, there are effective measures in place to ensure the UoA does not hinder recovery and rebuilding.

MPI (2017) note that no summaries of observed fish and invertebrate bycatch in snapper target fisheries are currently available, so the best available information is from research fishing conducted in the areas where target fisheries take place.

MPI (2016a) reports that "*some bycatch information is available from some fishery characterisation studies*[1]*… but there were no detailed analyses of bycatch and discards from inshore fishing principally because of the lack of observer data. Most of the analyses of bycatch and discards for offshore fisheries were reliant on observer data, e.g., Anderson 2012, 2013a, and similar analyses for inshore fisheries are not currently possible. Past observer coverage of inshore fisheries was low (e.g., fewer than 2% of tows observed in 2009–10, Ramm 2012) and coverage was mainly focused on monitoring of Hector's and Maui's dolphin interactions and abundance for the Threat Management Plan. There are also practical and logistical problems with placing observers on smaller inshore vessels, and other options are being explored for the monitoring of these fisheries. This includes electronic monitoring using various configurations of video cameras, gear sensors, and position recording. Some progress has been made, but there remain some issues to surmount before electronic monitoring can provide all the information required to estimate fish and invertebrate bycatch. However for the SNA 1 fishery MPI has committed to 100% observer or camera coverage for all trawl vessels from October 1, 2015, and research into estimation of all fish bycatch and discards using electronic monitoring is planned for 2015–16 (ENV2015-04).*"

Given the absence of discard information for all sectors, it is not possible to assess impacts and all UoAs are assessed as precautionary high risk. The introduction of electronic monitoring in some sectors may help to better characterise discards.

[1] Most of the cited examples are unpublished reports held by MPI.

SNA1 – Trawl **PRECAUTIONARY HIGH RISK**

New Zealand's inshore trawl fisheries are complex, multi-species fisheries, harvesting a wide range of inshore finfish species. The composition of the catch can vary considerably in space and time based on variations in recruitment, changes in market demand and the like. Information on the retained portion of the catch is very strong, reported and verified through the QMS reporting arrangements. Information on the discarded portion of the catch is considerably more limited. Observer coverage in inshore fisheries has historically been very low (or absent from some sectors), and the main information on overall catch composition comes from independent trawl surveys, which may not be an accurate reflection of commercial catch composition (for example different gear may be used). There is also limited reporting of discards in commercial catch returns.

MPI (2017) report that the main QMS bycatch species taken in SNA 1 are trevally, red gurnard, John dory and tarakihi. They also report that *"more than 70 species have been captured in trawl surveys within SNA 1 but catches are dominated by snapper. Kendrick & Francis (2002) noted the following species in more than 30% of tows by research vessels Ikatere and Kaharoa: jack mackerels (three species), John dory, red gurnard, sand flounder, leatherjacket, rig, eagle ray, lemon sole, and trevally (see also Langley 1995a, Morrison 1997, Morrison and Francis 1997, Jones et al 2010). Smaller numbers of invertebrates are captured including green-lipped mussel, arrow squid, broad squid, octopuses, and scallop (Langley 1995a, Morrison 1997, Morrison & Francis 1997 and Jones et al 2010)".*

Some of the best (albeit dated) composition and volume information comes from Morrison & Francis (1997) who caught 46 species during trawl surveys in Hauraki Gulf in 1997. Snapper accounted for 71.3% of the catch by weight, while jack mackerel (*Trachurus novaezealandae*), leatherjacket (*Parika scaber*), john dory (*Zeus faber*) and red gurnard (*Chelidonichthys kumu*) accounted for 11.8%, 3.9%, 3.6% and 2.0% respectively. Species other than these were taken only rarely.

In a trawl survey in the Bay of Plenty, Morrison (1997) caught seventy-one species. Snapper accounted for 40.4% of the total catch by weight, jack mackerel accounted for 10.4%, while frostfish (*Lepidopus caudatus*), red gurnard and john dory accounted for 9.6%, 5.5% and 2.4% respectively.

Assuming these studies are a reasonable reflection of current catch composition, species likely to account for >5% of the catch (and therefore considered 'main' species) may include:

- Jack mackerel (*T. novaezealandiae*);
- Leatherjacket
- Frostfish
- Red gurnard.

Information on each of these species as well as indicative scoring (via colour code) against the SGs is included below.

Jack mackerel

The most recent assessment of jack mackerel in JMA1 was undertaken in 1993, and the most recent MPI stock status summary lists the status of jack mackerel as unknown. MPI (2017) concludes that "it is not known whether catches at the level of the current TACCs or recent catch levels are sustainable in the long-term". It is possible that the level of catch taken by the SNA1 trawl sector is insufficient to hinder recovery of JMA (if necessary), but more information would need to be known on catches and stock status to make an effective judgement.

Leatherjacket

The stock structure of leatherjacket is unknown. There has been no scientific assessment of the maximum sustainable yield, reference or current biomass of any of the leatherjacket stocks (MPI, 2017).

Frostfish

MPI (2017) reports that "*estimates of current and reference biomass are not available. The stock structure is uncertain; the fishery is variable and almost entirely a bycatch of other target fisheries. No age data or estimates of abundance are available. It is therefore not possible to estimate yields. It is not known if recent catches are sustainable or whether they are at levels that will allow the stock to move towards a size that will support the maximum sustainable yield*."

Red gurnard

No information is available on stock separation of red gurnard (MPI, 2017). For the purpose of MPI Plenary reports, GUR 1 is considered to be a single stock with three sub-stocks (MPI, 2017). The most recent plenary report for the relevant sub-stock (GUR 1E) concluded that, based on standardised CPUE trends, the stock was about as likely as not (40–60%) to be at or above B_{MSY} and it was unlikely (<40%) that the stock is below the soft limit.

Importantly, successful trials of video monitoring were undertaken in 2014, and agreements have recently been reached to apply video monitoring to the full SNA1 trawl fleet. Information made available from this initiative will likely strengthen the performance of the fishery against this indicator, and should be taken into consideration in future scoring.

SNA1 - BLL **PRECAUTIONARY HIGH RISK**

MPI (2017) note that for SNA 1, information on the bycatch associated with research longlining during tagging surveys is available, although restricted to the inner and western parts of the Hauraki Gulf. The most common bycatch species in this area included: rig, school shark, hammerhead shark, eagle ray, stingrays, conger eel, trevally, red gurnard, jack mackerels, blue cod, John dory, kingfish, frostfish and barracouta (Morrison and Parsons unpublished data). Information on which of these species is likely to be considered a 'main' other species (i.e. >5% of the catch by weight) is not known.

While it is not known whether rig stocks on the west and east coasts of the North Island are separate they are assessed separately (1E and 1W) for the purposes of the Plenary reports. For SPO1E the most recent assessment was undertaken in 2016 and lists the status in relation to target and limit reference points, as well as overfishing limits, as unknown (MPI, 2017). The assessment notes that adult biomass (as indexed by the set net fishery in Statistical Area 007) has fluctuated without trend since 1990, while fishing intensity appears to have been declining since the mid-1990s.

School shark is likely (>40%) to be above the hard limit (10% of B_0) but it is not known whether it is above the soft limit, or whether overfishing is occurring. The status of hammerhead sharks is unknown. On this basis we have scored this SI precautionary high risk. Nevertheless, if additional information becomes available which would better inform scoring, this SI should be re-assessed.

SNA1 – Danish seine

No information on catch composition and volume in the Danish seine fishery was found. This is consistent with the general advice on the lack of non-ETP bycatch characterisation in New Zealand's inshore fisheries (e.g. MPI, 2016a), largely due to low observer coverage. If more information becomes available in future, this SI should be rescored.

SNA2 - Trawl **PRECAUTIONARY HIGH RISK**

MPI (2017) note that snapper is a bycatch of the main inshore fisheries within SNA 2, principally the red gurnard and tarakihi bottom trawl fisheries. The operation of these fisheries is constrained by the SNA 2 TACC.

Red gurnard

The most recent assessment of red gurnard in GUR 2 was undertaken in 2014. The assessment used standardised CPUE and concluded the stock was "About as Likely as Not (40–60%) to be at or above the target". The assessment also concluded that:

- It was unlikely (<40%) that the stock was below the soft limit;
- It was very unlikely (<10%) the stock was below the hard limit; and
- Overfishing is Unlikely (< 40%) to be occurring (based on estimates of Z)

Based on this, it appears highly likely that the stock is above PRI.

Tarakihi

MPI (2017) report that "the stock relationships between TAR 2 (including TAR 1 BoP) and TAR 3 are unclear. Data from the main fisheries reveal similarities in abundance trends and age composition and it is possible that the two areas represent a single tarakihi stock or, at a minimum, that there is substantial connectivity between the two areas. However, definitive conclusions regarding the stock structure are not possible" and hence TAR 2 and TAR 3 are assessed separately.

TAR 2 was most recently assessed in 2012 based on a standardised CPUE series from the mixed target species bottom trawl fishery. MPI (2017) report that there is "no strong long-term trend since the early 1990s, with current levels slightly below the levels observed at the beginning of the series, interrupted by 5 years of increased CPUE in the early 2000s". They conclude that the position of the stock against target and soft limit reference points is unknown, but it is unlikely (<40%) the stock is below the hard limit.

SNA2 - BLL **PRECAUTIONARY HIGH RISK**

No specific information on the non-target species catch composition of the SNA 2 fishery was found. Should information become publicly available, this SI should be rescored.

SNA7 – Trawl **PRECAUTIONARY HIGH RISK**

Snapper is taken as a bycatch of the inshore trawl fisheries operating within FMA 7, particularly within Tasman Bay and Golden Bay (MPI, 2017). MPI (2017) report that "*trawl surveys targeting juvenile snapper in Tasman and Golden Bays have captured more than 50 finfish species. Common bycatch species (Blackwell & Stevenson 1997) were: spiny dogfish, red cod, barracouta, red gurnard, jack mackerel (three species), hake, blue warehou, tarakihi and porcupine fish. Invertebrates captured included sponges, green-lipped mussel, octopuses, arrow squid, nesting mussel, and horse mussel.*"

Snapper were also reported in more recent inshore trawl surveys in the west coast of the South Island and Tasman and Golden Bays (Stevenson and Hanchet, 2010), but represented only around 1% of the catch by weight. Species accounting for >5% of the catch by weight from this survey included: spiny dogfish (*Squalus acanthias*; 25%); Barracouta (*Thyrsites atun*; 10%), red cod (*Pseudophycis bachus*; 11%) and silver dory (*Cyttus novaezealandiae*; 6%).

While the data to determine species composition and volume of commercial catches is limited, based on the above two studies, species likely to account for >5% of the catch by weight include:

- Spiny dogfish;
- Barracouta; and
- Red cod.

Spiny dogfish

MPI (2017) report that "*no estimates of current or reference biomass are available, but trawl survey estimates of abundance are all at or above the long term average (1991–2011 for Chatham Rise and 1992-2011 for WCSI).*" While there is insufficient evidence to indicate it is highly likely that stocks are above PRI, the biomass estimates on the West Coast of the South Island (MPI, 2017) suggest that recruitment is not currently impaired.

Barracouta

The most recent assessment of BAR 7 was undertaken in 2016, using standardised CPUE (MPI, 2017). The WG considered that the tow level CPUE was the best data to use to monitor this stock. The CPUE shows an increasing trend from 2000 to 2004 and is then generally flat. Similar trends were observed in West Coast North Island (WCNI) and West Coast South Island (WCSI) trawl surveys. MPI (2017) conclude that the stock is very unlikely (< 10%) to be below both the soft and hard limits.

Red Cod

Stock boundaries are unknown, but for the purpose of the NZ stock assessment plenary reports RCO 7 (which largely overlaps with SNA 7) is considered to be a single management unit. The stock is primarily assessed using biomass indices from the West Coast South Island trawl survey which the Southern Inshore Working Group agreed was a credible measure of biomass. The most recent survey was undertaken in 2015 and was the third lowest in the time series (commencing 1991-2). The result continues an overall declining trend since 2009, although it is associated with a relatively high CV (45%). MPI (2017) note that the lack of 1+ fish in 2015 is of concern for a recruitment-driven fishery, however the record number of 0+ fish in the 2015 survey may help sustain the fishery in the short term.

MPI (2017) report that the status of the stock in relation to target and soft limit reference points is unknown, although it is unlikely (>40%) that the stock is below the hard limit. The trend in fishing mortality is unknown.

Based on the above, the position of the stock in relation to PRI is not known with confidence, although the record numbers of 0+ fish suggests that recruitment may not be impaired.

Although each retained species likely to qualify as main other appears to be at least likely to be above the point of recruitment impairment, the absence of information on discards and total catch composition means this SI scores precautionary high risk.

SNA7 – BLL **PRECAUTIONARY HIGH RISK**

No specific information on the non-target species catch composition of the SNA 7 fishery was found. Should information become publicly available, this SI should be rescored.

SNA8 – Trawl **PRECAUTIONARY HIGH RISK**

Over 80 species have been captured in trawl surveys within SNA 8. Red gurnard, jack mackerel (three species), trevally, barracouta, school shark, spiny dogfish, rig, John dory and porcupine fish were the most abundant finfish (Langley 1995b, Morrison 1998, Morrison & Parkinson 2001; in MPI, 2016a). Few invertebrates other than arrow squid were caught (Morrison & Parkinson 2001). The primary species caught in association with snapper in bottom trawl fisheries are trevally, red gurnard, John dory and tarakihi.

Some of the best (albeit dated) composition and volume data appear to come from Morrison and Parkinson (2001) who undertook trawl surveys on the west coast of the North Island. Seventy-one species (68 finfish, 3 invertebrates) were caught during the surveys. Those accounting for >5% of the catch by weight included red gurnard which accounted for 21.3% of the catch, snapper 18.7%, trevally (*Pseudocaranx dentex*) (11.3%), jack mackerel 9.4% and 6.4% (*T. novaezealandiae* and *T. declivis* respectively).

Red gurnard

SNA 8 overlaps with the GUR 1 and 8 QMAs. MPI (2017) reports that GUR 1 is considered to be a single stock with three sub-stocks (GUR 1W, GUR 1E, GUR 1 Bay of Plenty). The most recent stock assessments for each stock were undertaken in 2013 (MPI, 2017), using standardised CPUE. Each stock was assessed against stock-specific B_{MSY}-compatible reference points consistent with the HSS. MPI (2017) concluded that each stock was as likely as not to be above the B_{MSY} proxy target reference point, unlikely (<40%) to be below the soft limit (50% B_{MSY}) and very unlikely to be below the hard limit (25% B_{MSY}). Given the above, the combined stock appears highly likely to be above the point of recruitment impairment.

For GUR8, no stock specific assessment of current status against reference points is presented in MPI (2017). Accordingly, we have scored this SI precautionary high risk.

Trevally

The TRE 7 stock overlaps with the SNA 8 QMA. Trevally occurring along the west coast of the North Island are believed to comprise a single stock (MPI, 2017). The most recent assessment of TRE 7 was undertaken in 2015. The assessment concluded that the stock was "very likely (> 90%) to be at or above the target" and that "overfishing is very unlikely (< 10%) to be occurring".

Jack mackerel

The JMA 7 stock overlaps with the SNA 8 QMA. MPI (2017) report that "estimates of total mortality for *T. declivis* (JMD) and *T.novaezelandiae* (JMN) from catch curve analyses in 2011 suggest that fishing mortality was well below M for JMD and about equal to M for JMN; i.e. it is unlikely (< 40%) that overfishing is occurring." Moreover, preliminary analysis of *T. declivis* in JMA 7 suggests that current biomass is at 53% of virgin biomass (B_0) (MPI, 2017). While the status of the stock overall is listed as unknown, and is complicated by the reporting of three 'jack mackerel' species collectively, the available information suggests it is unlikely jack mackerel are below the PRI.

SNA8 – Danish seine **PRECAUTIONARY HIGH RISK**

No information on catch composition and volume in the Danish seine fishery was found. This is consistent with the general advice on the lack of non-ETP bycatch characterisation in New Zealand's inshore fisheries (e.g. MPI, 2016a), largely due to low observer coverage. If more information becomes available in future, this SI should be rescored.

CRITERIA: (ii) There is a strategy in place that is designed to maintain or to not hinder rebuilding of other species; and the UoA regularly reviews and implements

(a) Management strategy in place

All Units of assessment **PRECAUTIONARY HIGH RISK**

The main management measures in place to ensure the UoAs maintain main other species at levels above PRI, or alternatively to not hinder their recovery, are the arrangements under the QMS, principally the setting of TACs in accordance with the Harvest Strategy Standard (HSS), the reporting and deemed values regime, and monitoring and reporting on status through the MPI Working Group process. Considerable spatial closures and gear restrictions also exist in some QMAs (e.g. Figure 6). Some independent observation of bycatch volume and composition has occurred although coverage has been infrequent and patchy. The best available public information for many stocks comes from independent research trawls, which may vary in operation and catch to commercial trawls. Little publicly available information was found on longline and Danish seine bycatch species volume and composition.

Assuming TACs/TACCs are set according to the HSS and in a way that ensures main other species populations are maintained above PRI, the QMS appears an effective mechanism to achieve the criteria 2A(ii). However, for many species the status in relation to PRI is unknown and it is not possible to conclude whether existing TACCs will lead to overfishing. For other UoAs (e.g. longline, Danish seine), there is limited information for examining which species are likely to be considered main other species. Accordingly, there is insufficient information to determine whether the existing measures are achieving their objective. To this end, we have scored these precautionary high risk.

(b) Management strategy evaluation PRECAUTIONARY HIGH RISK

Given the absence of good information on the species composition amongst most inshore NZ fisheries, together with the unknown status of many stocks, there appears to be insufficient information to determine whether the management arrangements are working.

(c) Shark-finning

Shark finning has been prohibited under New Zealand law since 1 October 2014[2].

CRITERIA: (iii) Information on the nature and amount of other species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage other species.

(a) Information PRECAUTIONARY HIGH RISK

Good quantitative information is available for several target species through the QMS reporting arrangements. For some stocks, this is sufficient to assess the impact of the UoA on main other species with respect to status and detect any increase in risk. For other main other species included in the QMS, the available quantitative information is not sufficient to assess the impact of the UoA on the stock. Information on discarded species is very limited. While some summaries of bycatch species have been included in fishery characterisation studies (e.g. Starr et al 2010a, b, c, Starr & Kendrick 2012, Starr & Kendrick 2013; in MPI, 2016a) these are often unpublished internal reports held by MPI. Given the absence of information on discards, and limitations in the information available for the stocks scored PHR under 1(a) above, we have scored this SI PHR. Current initiatives to introduce electronic monitoring in at least some inshore trawl sectors will improve the information base and assist with management.

PI SCORE	PRECAUTIONARY HIGH RISK – All units of assessment

2B: Endangered Threatened and/or Protected (ETP) Species

CRITERIA: (i) The UoA meets national and international requirements for protection of ETP species.
The UoA does not hinder recovery of ETP species.

(a) Effects of the UoA on populations/stocks

The risks of the snapper UoAs to ETP species appear to be largely gear-specific, although there are some regional differences in risk based on the distribution of ETP species. For this PI, we have grouped UoAs by gear type.

Trawl Units of Assessment PRECAUTIONARY HIGH RISK

The main potential ETP species interactions in the inshore trawl fisheries are with seabirds and marine mammals.

Interactions with protected corals are also possible, although Consalvey et al (2006) report that there are no shallow-water corals which form reefs in New Zealand waters, and Baird et al (2013) reported that fewer reports of coral catch were reported from observed fisheries in waters shallower than 800 m.

Seabirds

Between 2002–03 and 2014–15, there were 77 observed captures of all birds in inshore trawl fisheries (Figure 7), including New Zealand white-capped albatross (21), Salvin's albatross (19), flesh-footed shearwater (17), black petrel (7), grey-faced petrel (3), sooty shearwater (2), shearwaters (2), Westland petrel (2), white-chinned petrel (1), petrels, prions, and shearwaters (1), common diving petrel (1), and albatrosses (1) (Abraham and Thompson, 2015a). Based on rates of observer coverage, Abraham and Thompson (2015) estimate that between 400 – 600 seabirds are captured annually in New Zealand's inshore trawl fisheries each year.

[2] http://www.doc.govt.nz/news/media-releases/2014/shark-finning-to-be-banned-from-1-october/

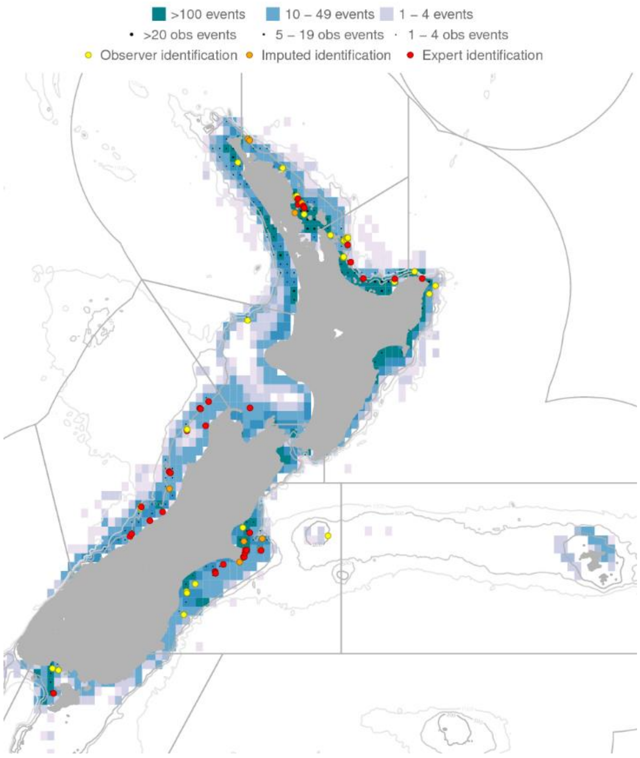


Figure 7: Map of fishing effort and observed captures in inshore trawl fisheries, 2002-03 to 2014-15 (Abraham and Thompson, 2015)

Risks to seabirds associated with New Zealand's commercial fisheries have been assessed through a hierarchical series of risk assessments (e.g. Rowe, 2013, Richard and Abraham, 2013; Richard and Abraham, 2015, Richard and Abraham, in prep.; in MPI, 2016a). The most recent iteration derives for each taxon a risk ratio, which is an estimate of annual potential fatalities (APF) across trawl and longline fisheries relative to the Population Sustainability Threshold, PST (based on but not the same as the Potential Biological Removals, PBR, approach) (Richard & Abraham in prep; in MPI, 2016a). This index represents the amount of human-induced mortality a population can sustain without compromising its ability to achieve and maintain a population size above its maximum net productivity (MNPL) or to achieve rapid recovery from a depleted state. The management criterion used for developing the seabird risk assessment was that seabird populations should have a 95% probability of being above half the carrying capacity after 200 years, in the presence of ongoing commercial fishing mortalities, and environmental and demographic stochasticity (Richard & Abraham, 2013).

In the most recent assessment, only one species of seabird, black petrel (1.15), had a median risk ratio higher than 1 (or upper 95% confidence limit higher than 2) taking into account fishing related mortality across all trawl and longline fisheries (Richard & Abraham in prep; in MPI, 2016a). For all other species, current rates of fishing related mortality were not expected to hinder the achievement of management targets (i.e. the risk ratio was <1). There are no national or international limits on black petrel bycatch.

The most recent quantitative modelling for black petrels concluded that the mean rate of change of the population had not exceeded 2% per year, though the direction of change was uncertain (Bell et al, 2012; in MPI, 2016a). The specific contribution of inshore trawl fisheries to black petrel APFs in the most recent risk assessment iteration is not known, but total estimated captures in trawl fisheries (including deepwater trawl fisheries) represent a small fraction of the overall estimated captures for black petrel (MPI, 2016a). There is also evidence from the most recent risk assessment that risk to black petrel has declined since the introduction of the current NPOA-Seabirds in 2013.

Of the other seabirds observed to be captured in inshore trawl fisheries, New Zealand white-capped albatross, Salvin's albatross and flesh foot shearwaters had median risk ratios of 0.35 (95% c.i. 0.21 – 0.58), 0.78 (0.51 – 1.09) and 0.67 (0.39 – 1.15) respectively. Of the two species, with upper 95% confidence intervals exceeding 1, the combined trawl sectors contributed only a small fraction of the estimated APFs for flesh-footed shearwaters, although the majority of APFs for Salvin's albatross (MPI, 2016a). The inshore trawl and flatfish trawl sectors accounted for around 40% of estimated captures across all trawl fisheries in recent years (Richard and Abraham, 2015).

Accordingly, the direct effects of the inshore trawl fisheries appear highly unlikely to hinder recovery of ETP seabird species.

Marine Mammals

Pinnipeds

Between 2002–03 and 2014–15, there were six observed captures of New Zealand fur seals, and no observed captures of New Zealand sea lions, in inshore trawl fisheries (Abraham and Thompson, 2015). Estimated captures of fur seals in the same period ranged from 40 to 114 annually. There were no observed or estimated captures of either species over the same period in the flatfish targeted trawl fisheries.

New Zealand fur seals are the most common seals in New Zealand and are listed as 'least concern', with an increasing population trend. There are no national or international limits on incidental captures of fur seals. Based on this it appears highly likely that current rates of capture are not hindering recovery of either species.

Dolphins

Hector's and Maui dolphin

MPI (2016a) note that "it is widely accepted that incidental mortality in coastal fisheries, notably set nets and to a lesser extent trawls, is the most significant threat to Hector's and Māui dolphins (MFish & DOC 2007, Slooten & Dawson 2010, Currey et al 2012)". Nineteen individual Hector's dolphins were reported caught in trawl fisheries between 1921 and 2008 and none since 2008 (MPI, 2016a).

Maui's dolphin is listed as 'critically endangered' on the IUCN's Red List of threatened species and 'nationally critical' in the New Zealand Threat Classification System. Current population estimates indicate that about 63 Maui's dolphins over 1 year of age remain (Baker et al, 2016).

Hector's dolphin is listed as 'endangered' by the IUCN and 'nationally endangered' in New Zealand. MacKenzie & Clement (2016; in MPI, 2016a) estimate the total Hector's dolphin population around the South Island (excluding sounds and harbours) to be 14 849 (CV: 11%, 95% CI 11 923–18 492). This estimate is approximately twice as large as the previous estimate from surveys conducted in the late 1990s – early 2000s (7300; 95% CI 5303–9966), with the difference primarily due to a substantial number of dolphins estimated to be in offshore areas (> 4nm) along ECSI that had not been extensively surveyed previously (MPI, 2016a).

MPI and DOC (2012) note that "*there have been no reported Maui's dolphin interactions with trawlers but trawling activity does overlap with Maui's dolphins range. Trawling is also known to catch other dolphin species off the WCNI and Hector's dolphins in South Island waters (albeit South Island trawlers have a higher probability of catching a Hector's dolphin due to higher dolphin abundance). MPI cannot determine if the absence of reported mortalities necessarily equates to the absence of trawl-related mortalities because monitoring of the WCNI trawl fleet is low*."

Currey et al (2012) assessed the cumulative impact and associated population risk posed by all threats to Maui's dolphins and also disaggregated the impacts of the individual threats to identify those threats that pose the greatest risk. The risk assessment used a semi-quantitative approach informed by an expert panel of 9 members. Commercial trawl fishing was estimated to be responsible for a median estimated mortality of 1.13 (95% CI: 0.01 – 2.87) individuals per year.

More recently Abraham et al (in prep; in MPI, 2016a) estimated captures of Hector's and Māui dolphin in set net and trawl fisheries by estimating a vulnerability from observed effort, observed captures, and the distribution of Hector's and Māui dolphin used in the marine mammal risk assessment. When estimates of possible live-release and subsequent survival of dolphin and cryptic mortality are included, the estimated number of annual fatalities of Hector's and Māui dolphin in trawl fisheries is 9 (95% c.i.: 1.1 -26.6) and 0.0 (95% c.i.: 0.0 - 0.1), respectively (Abraham et al in prep; in MPI, 2016a). The estimated cumulative fisheries risk score for Hector's dolphin varies from approximately 0.25 to slightly less than 1; the risk score for Māui dolphin is even more uncertain, ranging 0 to greater than 1 (Abraham et al, in prep.; in MPI, 2016a). Given the very low median estimates of annual fatalities in the trawl sector, the results of Abraham et al (in prep) are probably sufficient evidence that it is highly likely that the trawl fishery will not hinder recovery of either species.

Other dolphins

Between 2002–03 and 2014–15, there were five observed captures of common dolphin and one observed capture of a bottlenose dolphin in inshore trawl fisheries (Abraham and Thompson, 2015). Estimated annual captures of common dolphins in inshore trawl fisheries were relatively stable between 38 and 52. The majority of captures are estimated to have occurred in the Taranaki area, which overlaps SNA7 and SNA8 (Abraham and Thompson, 2015), although captures are estimates in most areas of the North Island and northern part of the South Island.

MPI (2016a) report that MPI contract PRO2012-02 is currently in progress to deliver the first iteration of a New Zealand Marine Mammal Risk Assessment (NZMMRA, Abraham et al in prep) applying the Spatially Explicit Fisheries Risk Assessment (SEFRA) method. Preliminary results reviewed by the AEWG in 2016 suggest that common dolphins are the species most at risk from New Zealand commercial fisheries. Estimated fisheries related deaths to common dolphins are attributable primarily to pelagic trawl fisheries, for which historically observed captures are sufficient to estimate vulnerability and risk with some confidence, and also to inshore trawl and setnet fisheries, for which species vulnerability (hence total captures) is very poorly estimated due to very low historical observer coverage (MPI, 2016a).

Given the uncertainty around setnet and inshore trawl fishery mortalities, cumulative fisheries risk for common dolphins remains highly uncertain, with an estimated risk score that may be less than half the Population Sustainability Threshold (PST) or may exceed the PST by a factor of two (MPI, 2016a). Preliminary estimates from the NZMMRA suggest setnets may account for the highest number of common dolphin mortalities, followed by pelagic trawl then inshore trawl, although the estimates for inshore trawl and setnets in particular are subject to very wide error bars.

Given the preliminary estimates of risk for common dolphins, including the possibility that the risk ratio from commercial fishing may be up to twice their PST, and that the inshore trawl fishery is important contributor to risk, we have scored this SI precautionary high risk. Nevertheless, because the inshore trawl estimates are sector wide we note they may overstate the risk attributable solely to trawls in which snapper are captured. Final results from the NZMMRA are expected in 2017 and future scoring should take these into account.

Demersal longline UoAs **HIGH RISK**

The main potential interaction with ETP species using longlines is with seabirds, although reports of incidental sea turtle captures have also occurred (e.g. MPI, 2017).

Between 2002–03 and 2014–15, there were 137 observed captures of all birds in snapper longline fisheries (. Observed captures were of flesh-footed shearwater (64), black petrel (37), Buller's shearwater (11), fulmars, petrels, prions and shearwaters (10), fluttering shearwater (6), southern black-backed gull (3), pied shag (2), Australasian gannet (2), red-billed gull (1), and northern giant petrel (1) (Abraham and Thompson, 2015). Based on rates of observer coverage, Abraham and Thompson (2015) estimate that between 560 – 780 seabirds are captured annually in New Zealand's snapper longline fisheries each year.

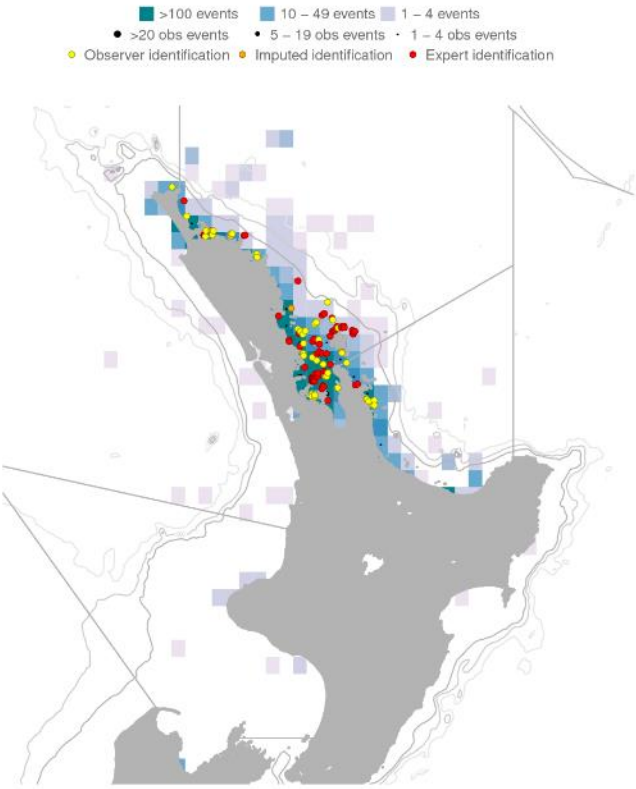
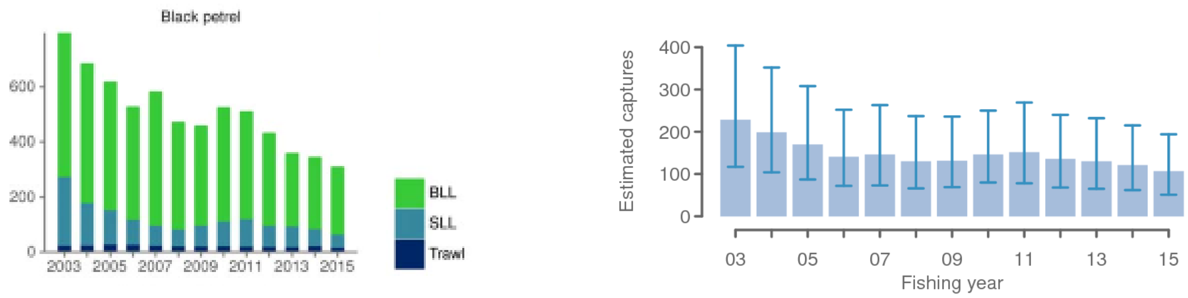


Figure 8: Map of fishing effort and observed seabird captures in snapper longline fisheries, 2002-03 and 2014-15 (Abraham and Thompson, 2015).

Of those species for which observed captures have occurred, two species – black petrel and flesh-footed shearwater – have a risk ratio upper confidence limit higher than 1 (Richard and Abraham, in prep. in MPI, 2016a). Black petrel was rated the highest risk species with a median risk ratio of 1.15. Black petrel are listed as Nationally Vulnerable in New Zealand. The most recent quantitative modelling for black petrels concluded that the mean rate of change of the population had not exceeded 2% per year, though the direction of change was uncertain (Bell et al, 2012; in MPI, 2016b).

Bottom longlining accounts for the majority of estimated captures of black petrel across New Zealand commercial fisheries (Figure 9a). Of the bottom longline sectors, the snapper targeted fishery accounts for the highest number of estimated captures. Between 2002–03 and 2014–15, mean estimated captures in the snapper bottom longline sector were between 106 and 228, albeit with high uncertainty (Abraham and Thompson, 2015). Estimated captures have generally declined since 2002-03 (Figure 9b), with the lowest estimated captures coming in 2014-15. Overall, the snapper targeted bottom longlining sector accounted for around 35% of the estimated captures of black petrel in New Zealand fisheries for the three most recent years reported (2012-13 – 2014-15).

The median risk ratio of 1.15 for black petrel has relatively wide 95% confidence intervals, with the lower confidence interval at around half the PST (0.51) and the upper confidence interval at more than twice the PST (2.03). Although the estimated captures for the snapper bottom longline sector on their own may not exceed a risk ratio of 1, the sector is the largest single contributor to the overall risk score and there is a plausible argument that captures in the sector could be hindering recovery. Accordingly, we have scored this SI high risk. Nevertheless, we note that captures in recent years have declined and there is evidence that relative risk to black petrels has declined since the introduction of the NPOA Seabirds in 2013 (Richard and Abraham, in prep; in MPI, 2016b). Future scoring should take into account any updates to risk assessments.



(a) *(b)*

Figure 9: (a) Estimated captures of black petrel in bottom longline (BLL), surface longline (SLL) and trawl sectors between 2002-03 and 2014-15 and (b) estimates captures of black petrel in New Zealand snapper bottom longline fisheries (Source: Abraham and Thompson, 2015).

For flesh-footed shearwaters, the median risk ratio from all forms of commercial fishing was estimated at less than 1 (0.67), although the upper confidence interval exceeded 1 (0.39 – 1.15) indicating there is some probability that current mortalities exceed the PST

(Richard and Abraham, in prep. in MPI, 2016a). Bottom longlining has accounted for around 59% of estimated mortalities in the past three years, with the snapper longline fishery accounting for around 38% of total estimated captures in commercial fisheries (Abraham and Thompson, 2015). Accordingly, it is probable that the snapper longline sector on its own would not exceed the PST for flesh-footed shearwaters although in combination with mortalities from other commercial fishing sectors, there is some possibility that total mortalities may lead to a population decline.

Danish seine UoAs **LOW RISK**

The main potential interaction in the Danish seine fishery is with seabirds.

Rowe (2013) reported that "*the presence of a codend presents some risk to seabirds, but there are no warps. Therefore, workshop participants agreed that this fishing method presented less risk to seabirds than trawling methods. Based on the description of this method, the workshop participants considered that seabird interactions with this fishery were likely to be rare or unlikely*." All risk scores were low or negligible, implying that no specific management action is needed in this fishery.

CRITERIA: (ii) The UoA has in place precautionary management strategies designed to:

- meet national and international requirements; and
- ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species

(a) Management strategy in place

Trawl units of assessment **PRECAUTIONARY HIGH RISK**

Demersal longline units of assessment **PRECAUTIONARY HIGH RISK**

The strategic framework for managing protected species interactions in New Zealand fisheries currently includes:

- Legislation: the Fisheries Act, Wildlife Act, and Marine Mammals Protection Act
- The National Plan of Action—Seabirds (MPI 2013c)
- The National Plan of Action – Sharks (MPI 2013d)
- The Marine Conservation Services Programme

When impacts of fishing are such that they are causing an adverse effect on protected species measures are to be taken pursuant to s15 of the Fisheries Act to avoid, remedy or mitigate that effect. If a Population Management Plan has been approved by the Minister of Conservation under either the Wildlife Act 1953 or the Marine Mammals Protection Act 1978 the Minister responsible for fisheries must give effect to those plans when managing the effects of fishing.

The Department of Conservation and Ministry for Primary Industries also contract research, including:

- population monitoring protected species;
- research relating to fishing effects on protected species; and
- research on measures to mitigate the adverse effects of commercial fishing on protected species.
-

Seabirds

Management measures to mitigate impacts of commercial fisheries on seabirds are included in the NPOA-Seabirds (MPI, 2013c). The measures are given effect through the national fisheries planning process, and vary by vessel type. Table 4 summarises the measures across New Zealand's main commercial fishing gear/vessel types (MPI, 2013c)

Within cells in the table:

- R = regulated;
- SM = required via a self-managed regime (non-regulatory, but required by industry organisation and audited independently by Government);
- V = voluntary with at least some use known;
- Cells blacked out indicate that the measure is not relevant in a particular fishery;
- A year in ( ) indicates the year of implementation;
- Measures annotated with * are part of a vessel-specific seabird risk management plan; and
- Large vessels are those 28m and greater in length.

On trawl vessels, seabird scaring devices such as paired streamer (tori) lines, bird bafflers and warp deflectors have been required on vessels >28 m in length since 2006. These measures are designed to reduce seabird mortality from warp strike in order to achieve or maintain a favourable conservation status for albatrosses and petrels, as required by ACAP. Non-regulatory measures include vessel-specific Vessel Management Plans, which describe various operational procedures to reduce risk to seabirds, such as how fishery waste will be managed. Offal management plans, vessel specific seabird risk management plans and codes of practice are also implemented via a self-management regime on trawl vessels >28m. The NPOA defines a vessel-specific seabird risk management plan as "*a plan which specifies seabird mitigation devices to be used, operational management requirements to minimise the attraction of seabirds to vessels, and incident response requirements and other techniques or processes in place to minimise risk to seabirds from fishing operations*."

For smaller trawlers, no seabird specific mitigation measures are mandatorily required other than the prohibition of net sonde cables. Nevertheless, approximately 25% of the NZ inshore trawl fleet under 28m have developed vessel specific seabird risk plans through CSP managed programmes. These vessels are South Island based where risk is assessed to be greatest e.g. Salvin's and whitecapped albatross. In addition, inshore trawlers in the upper North Island have been issued a set of specific guidelines to reduce risk of captures in the trawl net.

On bottom longline vessels, offal management is mandatory, as is night setting or line weighting. Streamer lines are mandatory on vessels >7m. A voluntary code of practice is in place for vessels >20m.

Table 4: Mitigation measures in place for New Zealand's fisheries under the National Plan of Action for Seabirds. (MPI, 2013c)

Mitigation Measure	*Surface longline*		*Bottom longline*			*Trawl*		*Set net*	*Notes*
	Large-vessel	*Small-vessel*	*Vessels >20m*	*Vessels 7-20m*	*Vessels <7m*	*Large-vessel*	*Small-vessel*		
Net sonde cable prohibition						R (1992)	R (1992)		Net sonde cables are also referred to as third wires
Seabird scaring device	R (Streamer line)	R (Streamer line)	R (Streamer line)	R (Streamer line)		R (2006)	V		On trawlers this is a recognised device which is designed to prevent warp captures and collisions
Additional seabird scaring device			V (second streamer line, gas cannon)			SM (2008)*	V		
Night setting	R (or line weighting)	R (or line weighting)	R (or line weighting)	R (or line weighting)	R (or line weighting)				Longline fleets must use night setting if not line weighting, or vice-versa.
Line weighting	R (or night setting)	R (or night setting)	R (or night setting)	R (or night setting)	R (or night setting)				
Dyed bait	V	V							
Offal management	V	V	R	R	R	SM (2008)*			
Vessel-specific seabird risk management plans						SM (2008)	V		Some vessel-specific seabird risk management plans have been developed for vessels < 28m
Code of Practice	V	V	V			SM (Vessel-specific seabird risk management plans)			

For larger trawl vessels (>28m), the measures outlined in the NPOA-Seabirds together with observer coverage and periodic risk assessments form a strategy to ensure the UoAs do not hinder recovery of ETP species. For smaller trawl vessels (<28m), fewer measures to mitigate seabirds are required and observer coverage has historically been lower. Nevertheless, risk assessments are updated periodically and there is evidence that new measures have been progressively introduced over time where required. Estimated captures of black petrel in inshore trawl fisheries have been stable between 16 and 27 birds annually between 2002-03 and 2014-15 (MPI, 2016a), which is low in the context of the total captures (Abraham and Thompson, 2015). Other seabird species have median risk ratios <1. Accordingly, the existing strategy appears likely to ensure the trawl UoAs do not hinder recovery of seabird species.

For snapper longline fisheries, the risks to black petrel, and to a lesser extent flesh-footed shearwaters, is greater and results from the most recent risk assessment suggest it is not clear that existing management measures restrict interactions to the extent that recovery is not hindered. Accordingly, we have scored this SI precautionary high risk for the longline UoAs.

Cetaceans

Hector's and Maui dolphin

The main management measure to limit interactions between trawling and Maui's dolphin is a prohibition on trawling between 0 and 2 nautical miles offshore between Maunganui Bluff and the Manukau Harbour, and Port Waikato to Pariokariwa Point (MPI/DOC, 2012). Within this area, between the Manukau Harbour and Port Waikato, trawling is prohibited between 0 and 4 nautical miles offshore. The restrictions were put in place in 2008 to manage the risk that trawlers in this area could catch Maui's dolphins. Trawling is also prohibited in defined areas including: Kaipara Harbour, Manukau Harbour, Hokianga Harbour, Waikato River Mouth, Raglan Harbour, Aotea Harbour, and Kawhia Harbour (Figure 10).

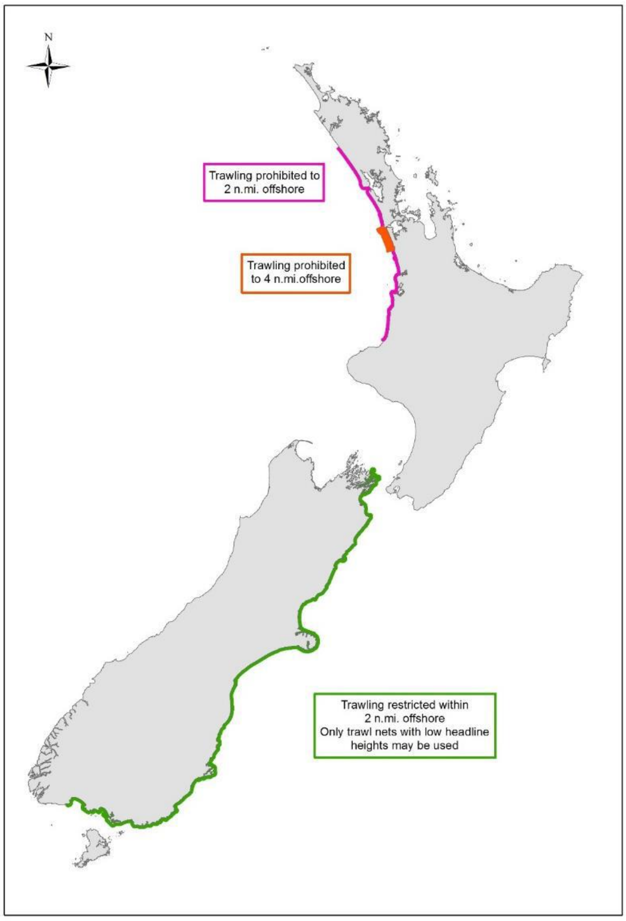


Figure 10: Restrictions on trawling introduced to mitigate impacts on Hector's and Maui dolphin. (MPI, 2016a)

The Maui's Dolphin Threat Management Plan was reviewed in 2013. The existing measures for trawling were retained, as well as extending monitoring coverage between two and seven nautical miles offshore from Maunganui Bluff to Pariokariwa Point. The intent of extending monitoring coverage was to:

- reduce the uncertainty in the risk trawling poses to Māui dolphins while enabling trawling to continue, and
- provide robust information to inform assessment of the level of interaction between trawl activity and the Māui dolphin population.

MPI/DOC (2016) report that in the 14 month period ending March 31, 2016, observer coverage in the West Coast North Island trawl fleet was 24%, and around 31.6% between November 2015 and March 2016. Within that period, there were no observer-reported or fisher-reported captures of Māui dolphins.

On the South Island, trawling is restricted within 2nm of the coast on the east and south coasts.

Given the absence on reported interactions and the updated risk assessment results for both Hector's and Maui dolphin (Abraham et al in prep; in MPI, 2016a), these measures appear to form a strategy that is expected to ensure the UoA does not hinder recovery.

Common dolphins

Between 2002–03 and 2014–15, there were five observed captures of common dolphin and one observed capture of a bottlenose dolphin in inshore trawl fisheries (Abraham and Thompson, 2015). Estimated annual captures of common dolphins in inshore trawl fisheries were relatively stable between 38 and 52. The majority of captures are estimated to have occurred in the Taranaki area (Abraham and Thompson, 2015), although captures are estimates in most areas of the North Island and northern part of the South Island.

MPI (2016a) report that MPI contract PRO2012-02 is currently in progress to deliver the first iteration of a New Zealand Marine Mammal Risk Assessment (NZMMRA, Abraham et al in prep) applying the Spatially Explicit Fisheries Risk Assessment (SEFRA) method. Preliminary results reviewed by the AEWG in 2016 suggest that common dolphins are the species most at risk from New Zealand commercial fisheries. Estimated fisheries related deaths to common dolphins are attributable primarily to pelagic trawl fisheries, for which historically observed captures are sufficient to estimate vulnerability and risk with some confidence, and also to inshore trawl and setnet fisheries, for which species vulnerability (hence total captures) is very poorly estimated due to very low historical observer coverage (MPI, 2016a).

Given the uncertainty around setnet and inshore trawl fishery mortalities, cumulative fisheries risk for common dolphins remains highly uncertain, with an estimated risk score that may be less than half the Population Sustainability Threshold (PST) or may exceed the PST by a factor of two (Abraham et al in prep, in MPI, 2016a). Preliminary estimates from the NZMMRA suggest setnets may account for the highest number of common dolphin mortalities, followed by pelagic trawl then inshore trawl, although the estimates for inshore trawl and setnets in particular are subject to very wide error bars.

Given the preliminary estimates of risk for common dolphins, including the possibility that the risk ratio from commercial fishing may be up to twice their PST, and that the inshore trawl fishery is important contributor to risk, we have scored this SI precautionary high risk. Final results from the NZMMRA are expected in 2017 and future scoring should take these into account.

Danish seine units of assessment LOW RISK

Given the relatively minor level of interaction between the Danish seine sector and seabirds, Rowe (2013) concluded that no additional management measures were required.

(b) Management strategy implementation LOW RISK

Trawl units of assessment PRECAUTIONARY HIGH RISK

For seabirds, periodic risk assessments (e.g. Richard and Abraham, in prep; in MPI, 2016a) provide an objective basis for confidence that the strategy will work, and modelling suggests progress has been made on reducing risk for key species (e.g. black petrel) since the introduction of the 2013 NPOA-Seabirds. To that end, there is at least some evidence that the strategy is being implemented successfully.

For Hector's and Maui dolphin, the most recent risk assessment results (Abraham et al, in prep; in MPI, 2016a) suggest that estimated mortality rates in trawling are low and provide an objective basis for confidence that the strategy will work. The absence of reported captures of Maui dolphin in the inshore trawl fishery on the west coast of the North Island despite higher rates of observer coverage provides some evidence the strategy is being implemented successfully.

The main uncertainty is the extent to which management measures serve to mitigate interactions between inshore trawl vessels and common dolphin given the preliminary outcomes of the NZMMRA (Abraham et al in prep, in MPI, 2016a). Future scoring of this SI should take into account the final outcomes of the risk assessment.

Longline units of assessment PRECAUTIONARY HIGH RISK

The extent to which the snapper bottom longline sector is contributing to overall black petrel mortalities is uncertain given the very low rate of observer coverage (0-2% between 2002-03 and 2014-15). While the measures in place (offal management, streamer lines, night setting/line weighting) could be considered likely to work, recent modelling indicates the median risk to black petrel across New Zealand fisheries remains above its PST (albeit with considerable uncertainty).

Danish seine units of assessment LOW RISK

The existing observer coverage, albeit limited in many years, provides some objective basis for confidence that the existing measures will work.

CRITERIA: (iii) Relevant information is collected to support the management of UoA impacts on ETP species, including:

- information for the development of the management strategy;
- information to assess the effectiveness of the
- management strategy; and
- information to determine the outcome status of ETP species.

(a) Information LOW RISK

Notwithstanding the absence of high levels of onboard observer coverage in the snapper fisheries, sufficient information appears to exist to undertake sophisticated assessments of the risk to ETP from the main sectors in the SNA fishery (e.g. Rowe, 2013; Richard and Abraham, 2013; 2015; in prep; Abraham et al, in prep). This information is sufficient to meet low risk, although confidence in the information base for assessments are likely to improve with additional independent monitoring. Implementation of electronic monitoring across some sectors of the fleet may strengthen performance against this indicator.

PI SCORE	LOW RISK – Danish seine UoAs
	PRECAUTIONARY HIGH RISK – Trawl UoAs
	HIGH RISK – Bottom longline UoAs

2C: Habitats

CRITERIA: (i) The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area(s) covered by the governance body(s) responsible for fisheries management

(a) Habitat status

Trawl UoAs MEDIUM RISK

In the context of habitats, MSC defines "serious or irreversible harm to structure and function" as the "*reduction in habitat structure, biological diversity, abundance and function such that the habitat would be unable to recover to at least 80% of its unimpacted structure, biological diversity and function within 5-20 years, if fishing were to cease entirely*" (MSC, 2014). Examples of "serious or irreversible harm" to habitats include the loss (extinction) of habitat types, depletion of key habitat forming species or associated species to the extent that they meet criteria for high risk of extinction, and significant alteration of habitat cover/mosaic that causes major change in the structure or diversity of the associated species assemblages (MSC, 2014).

It is recognised that when demersal trawl gear touches the bottom, damage may be done to the benthic environment and the communities that dwell there. Depending on the type of habitat, type of interaction, its duration and frequency; some areas may receive permanent damage while other areas will be able to recover in relatively short time periods. Damage to some habitats occurs with minimal trawling and will be long lasting due to the nature of the benthic organisms and the depth (e.g. biogenic habitat with vertical relief). Damage will, however, be restricted to areas trawled so that, the extent of any damage will be in proportion to the trawl footprint of the fishery (MRAG Americas, 2016).

MPI (2016a) report that the widespread nature of bottom trawling suggests that fishing is the main anthropogenic disturbance agent to the seabed throughout most of New Zealand's EEZ. In an in situ study in the Hauraki Gulf, Thrush et al (1998) were able to attribute broad-scale changes in macrobenthic communities to fishing disturbance. Along a gradient of decreasing fishing pressure these authors observed: increases in the density of echinoderms and long-lived surface dwellers; increases in the total number of species and the Shannon-Weiner diversity index; and decreases in the density of deposit feeders and small opportunists. They concluded that: "*the removal of organisms that add three-dimensional complexity to benthic habitats is potentially extremely destructive, as is the homogenization of sediment characteristics by the physical action of dredges and trawls."* In another study in Tasman and Golden Bays, Tuck et al (2011[3]; in MPI, 2016a) found that "*fishing was consistently identified as an important factor in explaining variance in community structure, with recent trawl and scallop effort being more important than other fishing terms."*

More recently, Tuck et al (2017) examined the impact of trawling on soft sediment habitats in New Zealand's EEZ based on existing and new research. They found that:

- "*The magnitude of the effects of fishing (% variability explained) varied between studies, and as would be expected, greater effects were detected over stronger effort gradients";*
- *"When effects were detected, fishing was associated with reductions in the number of taxa, diversity and evenness of both epifaunal and infaunal communities, but more consistently for epifauna. Fishing appears to have reduced epifaunal biomass and productivity (whole community and fish prey) by up to 50% in some of the study sites, but effects on infauna were less consistent (increasing by up to 20% in the one area an effect was detected). The species that were most consistently identified as being negatively correlated with fishing pressure were those that either stand erect out of the seabed (e.g., horse mussels, sponges, bryozoans, hydroids, sea pens, tube building polychaetes), or live on the sediment surface, and thus are particularly sensitive to physical disturbance through either direct physical impact (e.g., Echinocardium), smothering (e.g., small bivalves) or increased vulnerability to predation following disturbance (e.g., brittle stars)";* and
- *"Where examined, even relatively modest levels of fishing effort (i.e., fishing an area between once and twice per year, estimated at the 5 km × 5 km scale) reduced the density of the combined group of long lived sedentary habitat forming species and individual species group densities of holothurians, crinoids, cnidarians and bryozoans by at least 50%."*

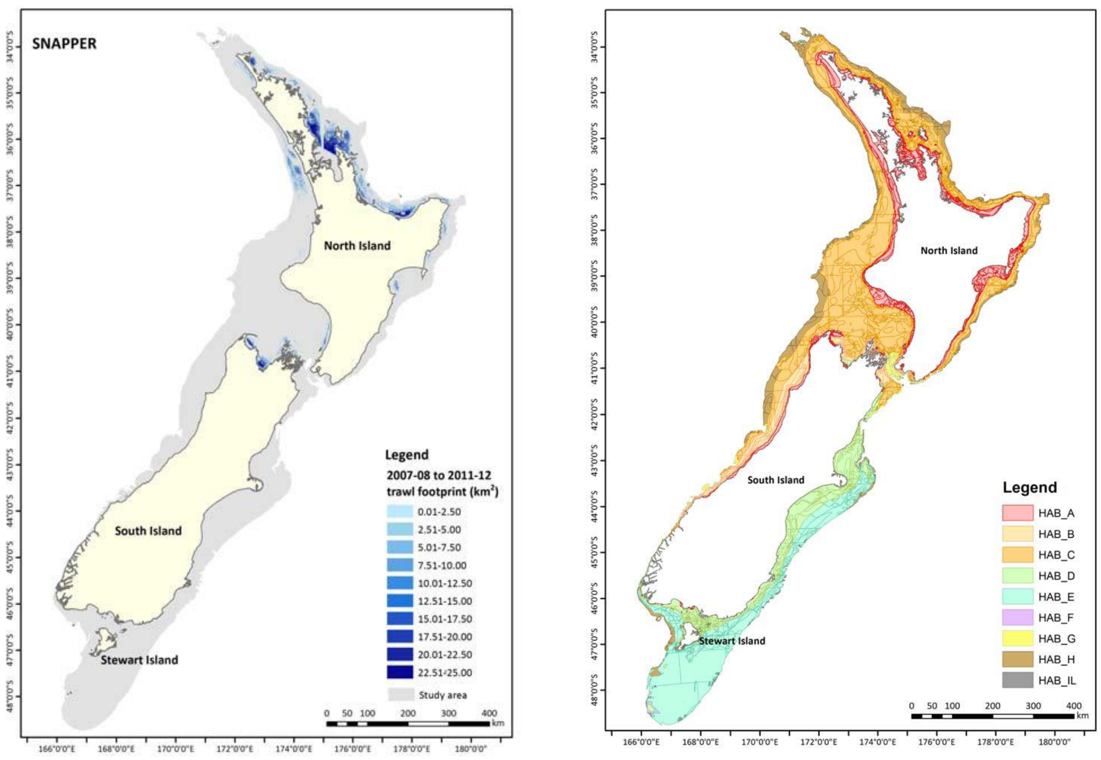
Assessing the risk of trawling to benthic habitats at the scale of individual habitats in practice requires information on the vulnerability of individual habitats types, the spatial extent of disturbance in the context of the full habitat area and the capacity of the habitat to recover. To examine the spatial footprint of trawling in the context of New Zealand's inshore benthic habitats, Baird et al (2015) overlaid the combined TCER and TCEPR 2007–08 to 2011–12 fishing years trawl footprint on Benthic-Optimised Marine Environment Classification (BOMEC) (Leathwick et al, 2012) classes shallower than 250m. Trawls listing snapper as a target species accounted for around 14% of TCEPRs and 5% of TCER assessed. The aggregated swept area estimated for effort reported on TCEPRs (i.e. vessels >28m) and TCERs in which snapper was recorded as a target species was 8,806.2km^2 and 10,568.5 km^2 respectively. The total cell footprint for snapper targeted trawls was 11,240.4 km^2 (Figure 11).

Much of the snapper targeted trawl effort occurred in BOMEC class C, with lesser amounts in classes A, B and D. Around 53% of the class C area was trawled in the 2007-8 to 2011-12 period when effort across all inshore trawl fisheries was considered, with coverage in classes A, B and D 51%, 76% and 64% respectively.

Nevertheless, while the footprint calculations were precise, Baird et al (2015) concluded that the data used to represent benthic habitats "were ill-suited for the task" and relied heavily on use of biological data from research surveys beyond the 250m contour. The authors also suggested that "*attempting to define 'habitats' for this area of the continental shelf over a relatively large latitudinal gradient is also problematic, particularly with respect to identifying communities that may exist in different benthic habitat classes.*" Attempts by these authors to test how the benthic habitat classes might be affected by the physical contact from bottom trawling, through measures of sensitivity of benthic organisms, also provided inconsistent results.

Moreover, while a number of studies have examined the vulnerability of different habitat types to trawling, MPI (2016a) note that fewer have assessed changes in ecological process or estimated rates of recovery. As a result, the understanding of the consequences of fishing (or of ceasing to fish) for sustainability, biodiversity, ecological integrity and resilience, and fish stock productivity in the wide variety of New Zealand's benthic habitats remains incomplete.

[3] This summary was based on an unpublished progress report to MPI. A publicly copy of the final report has not been located.



(a) (b)

Figure 11: (a) Cell-based trawl footprint for the five year data for snapper; (b) distribution of BOMEC classes within the 250 m contour (Baird et al, 2015).

In the absence of precise information on habitat distribution and recovery, available information on the extent of intense fishing effort and habitat vulnerability may be used to inform a judgement about the probability of serious or irreversible harm occurring. Tuck et al (2017) report that 'modest' or higher levels of fishing effort (i.e. fishing an area between once and twice per year, estimated at the 5 km × 5 km scale) occur in less than 10% of the area shallower than 100m. Of the 0-100m depth band, 8.8% is untrawled and 76.26% receives 0.5 or fewer trawls per year (Table 5). Of the 100-200m depth band, 26.94% is untrawled and 93.27% receives fewer than 0.5 trawls per year. While information on recovery is incomplete, the relatively limited spatial footprint of intense trawl effort provides a plausible argument that it is at least unlikely that the fisheries assessed here will reduce habitat structure and function to the point of irreversible harm at the scale of full habitats. Accordingly, we have scored this SI medium risk.

Table 5: Fishing intensity (number of times fished, averaged over most recent 5 years available) by depth band within the New Zealand EEZ. The years for which the data are presented vary depending on the data source, and are 2007/8 – 2011/12 for the coastal data, 2006/7 – 2010/11 for the TCEPR data. (from Tuck et al, 2017).

	Fishing intensity							
Depth range (m)	Not fished	<0.1	0.1–0.5	0.5–1	1–2	2–3.5	3.5–7.5	> 1
0–100	8.84%	38.23%	29.19%	14.51%	6.91%	2.11%	0.21%	9.23%
100–200	26.94%	43.50%	22.83%	4.86%	1.27%	0.43%	0.18%	1.87%
200–500	42.37%	42.32%	8.64%	3.22%	2.17%	0.93%	0.36%	3.46%
500–1000	74.06%	19.62%	3.17%	1.56%	1.15%	0.36%	0.08%	1.59%
1000–1600	90.26%	8.94%	0.75%	0.05%	0.01%			0.01%
1600–5000	99.41%	0.59%						
5000–10000	100.00%							

Nevertheless, the fisheries would be better placed against this SI with better information on inshore habitat distribution and the capacity for habitats to recover from trawling disturbance. We acknowledge that work in this area is ongoing and any advances in our understanding of benthic impacts should be considered in future assessments. For example, we note the outcomes of a 2015 expert workshop convened to address the question "what is the best scientific approach to assessing trawl and dredge impacts on benthic fauna and habitats in New Zealand in the short, medium and long-term?" (Ford et al, 2016). The workshop agreed that a fishing impact/productivity modelling approach to benthic risk evaluation was a useful starting point and would address the management need to ensure sustainability of benthic impacts by taking a risk-based approach. The approach relies on a number of model and prior development steps which are likely to take some years. Progress towards implementing this approach should be considered in future assessments.

Demersal longline units of assessment **LOW RISK**

While little quantitative information was found on the impacts of demersal longlining in New Zealand, the technique is generally considered to be relatively benign in its impacts on habitats although localised impacts on structured habitats can occur (e.g. Williams et al, 2011). This is consistent with the results on in situ experiments on the impacts on demersal longlining on vulnerable marine ecosystems (VMEs) elsewhere which have shown limited impacts (e.g. Pham et al, 2014).

In assessing the habitat impacts of the Ling bottom longline fishery in New Zealand, IFC (2014) noted "*the impacts of demersal longlining on the benthic habitat will be limited to the movement of longlines and anchors across the bottom on shooting and hauling, as well as due to shifting that results from underwater currents. Bottom-set longlines may snag on benthic epifauna, particularly to those corals that have a branching or bushy structure, and irregular objects on the bottom, and may damage or move objects, but may also break and gradually entangle itself around bottom features. The key determinant of the effects of longlines is how far they travel over the seabed during setting and retrieval. In addition to the line and hooks, anchors can be pulled some distance across the seabed before ascending. In general, however, longline fisheries offer the potential to conduct fisheries with less significant habitat damage. Impacts are generally considered to be relatively minor (but certainly not negligible). In turn, cold water corals are known to occasionally be brought up on longlines, although the potential impact is expected to be much lower than trawls, despite the fact that these gears can fish inside BPAs. A recent report on the distribution of coral species (primarily considered under 2.3) indicated that 'bottom longline fisheries... operate in areas where protected corals are found but the catch from these fisheries is not well understood.' This demonstrates the potential for benthic interactions, but these are expected to be negligible compared to bottom trawling*".

Accordingly, given the relatively limited likely footprint of the demersal longline sector and evidence of limited impact on VMEs elsewhere, it is probably highly unlikely that the UoAs would reduce habitat structure and function to the point of serious or irreversible harm. To that end, we have scored the UoAs low risk for this SI. Nevertheless, the information available is comparatively limited and would be assisted by analysis specific to bottom longline fisheries in New Zealand.

Danish seine units of assessment **MEDIUM RISK**

Baird et al (2015) reported a total of 26 768 Danish seine sets reported from a total of 36 vessels for 2007–08 to 2011–12. Twenty-one vessels made at least 500 sets over the five year period, which equates to about 90% of the total Danish seine effort. Sets targeted at snapper accounted for around 36.2% of sets. Snapper was targeted consistently in statistical area 006 (38% of all snapper sets) and in 008 and 009 (37% of snapper sets), with lesser effort in 003, 010, and 005.

Little specific information on the benthic impacts of the Danish seine fleet for snapper in New Zealand was found, however assessments of similar techniques elsewhere have concluded it has relatively limited impact, particularly when compared to otter trawling (e.g. Wayte et al, 2007). On this basis, we have scored these UoAs medium risk in that they are unlikely to result in serious or irreversible harm to benthic habitats, however the evidence base is comparatively weak and would be strengthened with more specific analysis of the coverage of Danish seines on vulnerable habitat types and likely rates of recovery.

CRITERIA: (ii) There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.

(a) Management strategy in place

Ackroyd and Pilling (2014) note that "*the Marine Reserves Act (1971) provides the basis for enacting protected areas within New Zealand, while the Conservation Act (1987), Wildlife Act (1953), and Fisheries Act (1996) also provide a framework for implementation. The New Zealand Biodiversity Strategy (2000) identified the need to develop a Marine Protected Areas Policy to protect a full range of natural marine habitats and ecosystems to effectively conserve marine biodiversity, using a variety of appropriate mechanisms, including legal protection. The MPI Strategy for Management of the Environmental Effects of Fishing provides a further framework for managing impacts, aiming to implement an Ecosystem Approach to Fisheries, make significant improvements in managing the environmental effects of fishing, and to ensure the Ministry for Primary Industries meets its environmental obligations under the Fisheries Act 1996 and other legislation in an efficient and consistent manner.*"

Trawl units of assessment **MEDIUM RISK**

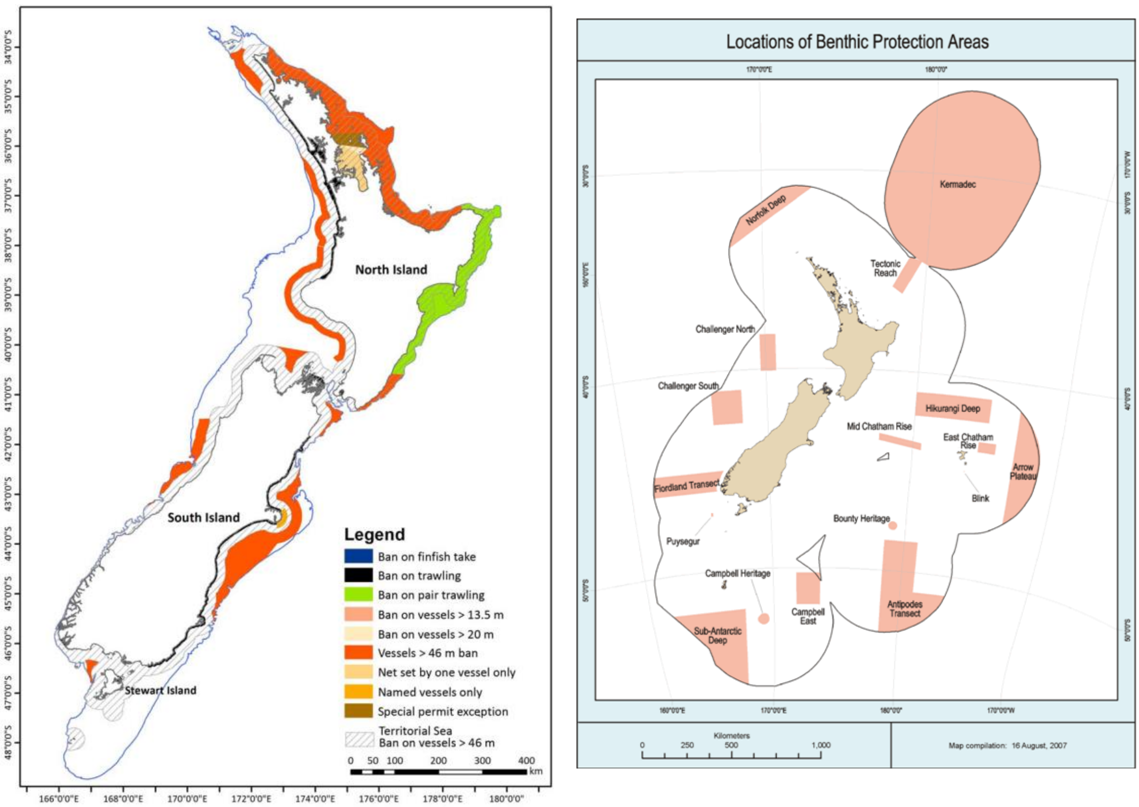
The main measures to manage fisheries impacts on habitat under a range of different legislative tools include:

(i) the closing of about one third of the New Zealand EEZ to bottom fishing though the designation of Benthic Protection areas (BPAs);
(ii) the designation of Marine Protected Areas (MPAs);
(iii) the designation of Marine Reserves;
(iv) closures to some forms of fishing (e.g. large trawl vessel closures) (Figure 12a); and
(v) monitoring vessel position.

Other closures may also serve to limit benthic impacts - e.g. Mataitai Reserves established under the Fisheries Act and cable and pipeline protection areas established under the Submarine Cables and Pipelines Protection Act 1996.

In addition, a substantial (and growing) body of research has been undertaken on the impacts of inshore trawling (e.g. see summarised in Tuck et al, 2017) and the footprint in relation to the main habitats types has been mapped (Baird et al, 2015). The limited observer coverage that has occurred in inshore trawl fisheries may also assist in benthic impact monitoring.

While very few of New Zealand's Benthic Protection Areas are located in inshore areas (Figure 12b), and the proportion of New Zealand's territorial waters (i.e. <12nm) covered by MPAs or other fisheries related closures is relatively small (when the sub-Antarctic Islands and Kermedec Islands marine reserves are excluded, less than 3% of NZ's territorial waters are included in areas where trawl, Danish seine and dredging are prohibited, and less than 5% is covered by MPAs. proportion of area is closed to trawl effort; DOC/MPI, 2011), the outcomes of Tuck et al (2017) showing intense trawling occurs in only a relatively small proportion of the area shallower than 200m and the commitment to ongoing research and management consistent with legislative and policy objectives (e.g. Fisheries Act, New Zealand Biodiversity Strategy, MPI Strategy for Management of the Environmental Effects of Fishing) provides a plausible argument that the current measures in place could be expected to achieve the outcome stated in criteria 2C(i). Accordingly, we have scored this SI medium risk.



(a) *(b)*

Figure 12: (a) Areas showing where trawling is prohibited and other relevant restrictions apply. Note the area shown as "Ban on pair trawling" also is closed to vessels > 46 m; and (b) location of Benthic Protected Area closures.

Nevertheless, as with criteria 2C(i)(a) above, the UoAs would be better placed with better placed with improved information inshore habitat distribution and the capacity for habitats to recover from trawling disturbance, as well as some form of evaluation demonstrating the management measures in place are sufficient to ensure the fisheries are highly likely to not result in serious or irreversible harm to habitat structure and function at the scale of full habitats.

Danish seine and demersal longline units of assessment MEDIUM RISK

The arrangements to limit the benthic impacts of demersal longlining and Danish seine are largely the same as those for trawling, although longlining is allowed in many of the trawl closures areas. Given the comparatively lesser impact of longlining and Danish seine compared to trawl, there is a plausible case that the existing arrangements will achieve the outcome stated in criteria 2C(i). Accordingly, we have scored this SI medium risk.

(b) Management strategy implementation

Trawl UoAs MEDIUM RISK

The outcomes of Tuck et al (2017) provide some objective basis for confidence that intense trawl effort is occurring in a relatively small proportion of habitats shallower than 200m. The main uncertainties are the extent to which more intense trawl effort occurs over habitats with limited capacity to recover, in the context of the full range of those habitats. Existing trawl closures appear to offer only limited protection to benthic habitats. Accordingly, we have scored this SI medium risk.

We note that the questions about the extent to which existing management measures protect benthic habitats at the species level may be informed by the type analysis recommended by the 2015 expert workshop (Ford et al, 2016) (i.e. rather than simply the extent to which habitat classes may be impacted by trawling, what is the impact of trawling at the species/population level, taking into the account the likely vulnerability of each species to trawling and the likely capacity to recover). The outcomes of any follow up research from this workshop should be factored into future assessments.

Danish seine and demersal longline units of assessment MEDIUM RISK

Given the impacts of habitat impacts of longlining and Danish seine are likely to be more limited, there is a plausible argument the existing arrangements should work, albeit there appears to have been more limited analysis of the footprint and likely impacts of these sectors.

CRITERIA: (iii) Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.

(a) Information quality

All UoAs MEDIUM RISK

Much of the information known about the impact of trawl fisheries on inshore benthic habitats in NZ is summarised in MPI (2016a) and Tuck et al (2017). Benthic surveys have been performed of seabed types around the New Zealand continental shelf and seamounts. There have been several attempts to use this information to develop a Territorial Sea and EEZ marine environment classification (e.g. MEC, BOMEC). There is ongoing collection of relevant data from vessel monitoring and research programs providing robust information on trawl footprint. Various research programs and projects are current and planned to address gaps in benthic and habitat knowledge.

The existing information is sufficient to broadly understand the types and distribution of main habitats, but less information appears to be available on the vulnerability and recoverability of impacts at a level of detail relevant to the scale and intensity of the fishery.

(b) Information and monitoring adequacy

All UoAs MEDIUM RISK

Information on the impacts of benthic trawls on structured and unstructured habitats is relatively well-studied elsewhere and there have been dedicated studies in New Zealand inshore fisheries (e.g. see summarised in Tuck et al, 2017). The likely impacts on the main habitats can be inferred from this information and there is very good information through catch records on the spatial extent of the fishery. The current information is at least sufficient to broadly understand the nature of the main impacts of gear use on the main habitats.

PI SCORE	**MEDIUM RISK – Trawl UoAs, Longline UoAs, Danish seine UoAs**

2D: Ecosystems

CRITERIA: (i) The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.

(i)(a) Ecosystem Status

Trawl and Danish seine UoAs MEDIUM RISK

Serious or irreversible harm in the ecosystem context should be interpreted in relation to the capacity of the ecosystem to deliver ecosystem services (MSC, 2014). Examples include trophic cascades, severely truncated size composition of the ecological community, gross changes in species diversity of the ecological community, or changes in genetic diversity of species caused by selective fishing.

Apart from impacts to ETP species, the main ecosystem level impacts from the UoAs are likely to come from removal of the target and bycatch species from the ecosystem, as well as through habitat modification. While considerable work has been undertaken to establish indicators to monitor the ecosystem impacts of fishing on New Zealand's ecosystem (e.g. Tuck et al, 2009; Pinkerton, undated), we have found few studies arriving at any form of conclusion about whether the existing ecosystem level impacts of New Zealand's inshore fisheries is likely to disrupt the key elements of ecosystem structure and function to a point where there would be serious or irreversible harm.

MPI (2016a) report that "*multi-species fishing at close to B_{MSY} using predominantly bottom-trawling is likely to make New Zealand's marine ecosystems less silient (compared to fishing more conservatively compared to B_{MSY} and not using predominantly bottom-trawling) to other anthropogenic disturbance and to environmental variability, including climate change, through trophic and ecosystem-level effects*." They also report that "*it is likely that the reduction in the abundance of sea urchin predators on some rocky reef systems in north-eastern New Zealand due to fishing has contributed to an ecosystem-level effect in these areas, but this effect is unlikely to be widespread in New Zealand coastal areas*". Schiel (2013) concluded that while urchin predators (including snapper) play a role in the dynamics of kelp beds only in some northern localities, environmental and climatic influences, species' demographics, and catchment-derived sedimentation are generally more important.

At a generic level, Ackroyd and Pilling (2014) note that "*at an EEZ level, New Zealand fisheries have been preliminarily assessed to be sustainable in an energetic context. However, Knight et al. (2011) note that this energetic-based sustainability assessment is not a replacement for a food web based analysis, and that their frameworks are appropriately deployed as a high level guide for monitoring cumulative effects of multiple fisheries, rather than considering removals at a species-specific level.*"

Tuck et al (2017) reported that trawling on soft sediments has implications for ecosystem functioning through at least four processes:

- reducing habitat complexity – habitat complexity is often positively correlated with species richness and can provide refugia from predation and higher densities of fish in some habitats. Reducing habitat complexity through the physical impact of trawling may result in reduced biodiversity and other changes in the composition of benthic community assemblages;
- decreasing bioturbation (surface sediment reworking and destabilisation) – changes in abundance of bioturbators (e.g. *Echinocardium*) can affect nutrient fluxes and primary productivity;
- decreasing suspension feeding – suspension feeding is an important connector between seafloor sediment and the water column increasing removal of both sediment and phytoplankton from the water column; and
- decreasing seafloor stability - increased density of habitat structure protects the seafloor from disturbance by waves and currents, sediment stabilisation.

While there are uncertainties around stock sizes for some target and byproduct species, the impact of discards and the extent to which fishing has already altered the underlying ecosystem structure (for example through habitat modification), given the existence of a productive fishery with relatively stable harvest levels for several decades across multiple inshore stocks, there is some intuitive basis to conclude that it is unlikely that the UoAs are disrupting the key elements of the ecosystem to the point where there would be serious or irreversible harm. The fact that trawling of moderate or high intensity occurs over only a small fraction of the area shallower than 200m provides further intuitive support. Accordingly, we have scored this SI medium risk. Nevertheless, given the potential for fishing for species at MSY using demersal trawl gear to influence ecosystem function and resilience, the fishery would be better positioned against this indicator with additional evidence to demonstrate that it was not disrupting the key elements underlying ecosystem structure and function to the point of serious or irreversible harm. We note that ecosystem modelling work is in process in some areas that may assist scoring against this SI in future assessments (e.g. NIWA marine food web modelling[4]).

Demersal longline UoAs **LOW RISK**

Given the more benign habitat impacts of longline gear, the main ecosystem level impacts from the UoAs are likely to come from removal of the target and bycatch species from the ecosystem and impacts to ETP species. Of the target species, two of the three snapper stocks targeted by longline gear are above the soft limit, while the third is at or around that level. Notwithstanding uncertainty around the composition of discards, overall volumes are likely to be lower than that taken in the trawl sector. The estimated impacts on the majority of ETP species are lower than their PST. Accordingly, while the information base is limited, there is probably a plausible argument that the longline UoAs are highly unlikely to disrupt the elements underlying ecosystem structure and function to the point of serious or irreversible harm.

CRITERIA: (ii) There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.

(a) Management Strategy in place **LOW RISK**

The New Zealand Fisheries Act 1996 s8 provides for "the utilisation of fisheries resources while ensuring sustainability." Ecosystem-based management is achieved through a multi-layered approach that considers fishery management (e.g. QMS), ETP management (protected species and related initiatives such as NPOA seabirds, the protection of marine mammals), and habitat considerations (e.g. MPAs, BPAs).

Legislated protection of areas from some sea bottom fishing activities, coupled with good quality monitoring of all fisheries removals that might impact on trophic structure and function and management of fishery removals (e.g. through TACCs) represent a partial strategy. Data from the fishery, including (limited) observer data together with fishery independent surveys and other research projects are taken into account in the management of the fishery. The main uncertainties are the effectiveness of the strategy on some ecosystem components – e.g. the impact of potentially reduced target species stock sizes on ecosystem function; the effect of habitat impacts on ecosystem structure and function – although MPI and industry have active research programs to resolve many of these issues. Overall, these measures constitute at least a partial strategy which could be expected to restrain impacts from each of the UoAs so as to achieve criteria 2D(i).

(b) Management Strategy implementation **MEDIUM RISK**

The types of measures applied in the partial strategy – e.g. maintaining target stock sizes at B_{MSY}, limiting impacts on ETP species – are likely to work based on plausible argument. Current ecosystem modelling may provide an objective basis for confidence in future assessments.

CRITERIA: (iii) There is adequate knowledge of the impacts of the UoA on the ecosystem.

(a) Information quality **LOW RISK**

Sufficient information is available on New Zealand's EEZ to broadly understand the key elements of the ecosystem (see, for example, MPI, 2016a) and information received through catch and effort monitoring, inshore trawl surveys, and monitoring of ecosystem indicators is likely to be adequate to detect any increased risk. Dietary analyses (e.g. Stevens et al 2011) provide information on the position of inshore trawl species in the food web.

(b) Investigations of UoA impacts **LOW RISK**

The main impacts of the fishery on the ecosystem elements such as structure and function can be inferred from the stock assessments, QMS catch trends, limited observer data, and surveys that cover the target species, related species, as well as specific research related to trawl impacts on habitat structure and function. Some of these impacts have been investigated in detail (e.g. Baird et al, 2015; Richard and Abraham, in prep), and there is ongoing research and data collection aimed at continuing to inform management with the aim of fulfilling the ecosystem objectives stated in the Fisheries Act.

PI SCORE	LOW RISK – Trawl UoAs, Longline UoAs, Danish seine UoAs

COMPONENT 3: Effective management

[4] https://www.niwa.co.nz/coasts-and-oceans/research-projects/marine-food-webs

3A: Governance and Policy

CRITERIA: (i) The management system exists within an appropriate and effective legal and/or customary framework which ensures that it:

- Is capable of delivering sustainability in the UoA(s)
- Observes the legal rights
- Created explicitly or established by custom of people dependent on fishing for food or livelihood; and
- Incorporates an appropriate dispute resolution framework.

(a) Compatibility of laws or standards with effective management **LOW RISK**

The 1996 Fisheries Law and subsequent amendments provide a binding legislative and legal framework for delivering the objectives of Components 1 and 2. The law identifies and sets requirements for cooperation among the parties involved in fishing activities.

The legal system transparently deals with resolution of legal disputes, as demonstrated by the protracted negotiations and court cases that settled the Maori claims. The resolution demonstrated that the system is effective and has been tested.

(b) Respect for Rights **LOW RISK**

Ackroyd et al (2017) report that "*MPI is responsible for the administration of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992, which implements the 1992 Fisheries Deed of Settlement under which historical Treaty of Waitangi claims relating to commercial fisheries have been fully and finally settled. The Ministry is also responsible for the Maori Fisheries Act 2004, which provides that the Crown allocates 20% of quota for any new quota management stocks brought into the QMS to the Treaty of Waitangi Fisheries commission. For non-commercial fisheries, the Kaimoana Customary Fishing Regulations 1998 and the Fisheries (South Island Customary Fishing) Regulations 1998 strengthen some of the rights of Tangata Whenua to manage their fisheries.*

These regulations let iwi and hapü manage their non-commercial fishing in a way that best fits their local practices, without having a major effect on the fishing rights of others.

The management system therefore has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2."

CRITERIA: (ii) The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.

(a) Roles and Responsibilities **LOW RISK**

The Minister responsible for the Fishery Act, the Ministry of Primary Industries (responsible for effective fishery management), the Department of Conservation (responsible for conservation issues such as ETP species and MPAs) are the main government entities involved in the management process. Each has clearly and explicitly defined roles. Stakeholders and independent experts are involved in the fisheries working group process which provides advice to MPI and the Minister.

(b) Consultation Process **LOW RISK**

The Fishery Act requires consultations among stakeholders with an 'interest' in the decision to be made, and the Stakeholder Consultation Process Standard provides guidelines for implementing the consultations. The consultation regularly seeks and accepts information, explains the use and results, and provides opportunity and encouragement for engagement. The Minister of Fisheries is required to consult with those classes of persons having an interest (including, but not limited to, Maori, environmental, commercial and recreational interests) in the stock or the effects of fishing on the aquatic environment in the area concerned.

In practice, MPI has a number of forums that provide for interested party participation in the assessment and management of the fishery. All stakeholders are actively encouraged to participate in the meetings or to provide submissions. These forums include specific working groups on management and research issues. Commercial, customary, and environmental fishery interests participate in each of these processes. In addition, interested groups representing environmental and wildlife interests, along with local community interests, are given opportunities to participate in these discussions or provide submissions.

CRITERIA: (iii) The management policy has clear long-term objectives to guide decision making that are consistent with Components 1 and 2, and incorporates the precautionary approach.

(a) Objectives **LOW RISK**

Long-term objectives to guide decision making are set out in the Fisheries Act, in Fisheries 2030 and other supporting documents (e.g. the Harvest Strategy Standard). These documents provide clear long-term objectives to guide decision-making, consistent with Components 1 and 2. The Fisheries Act (s10) also requires the application of a precautionary approach to decision making: "*All persons exercising or performing functions, duties, or powers under this Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account the following information principles:*

a) Decisions should be based on the best available information;
b) Decision makers should consider any uncertainty in the information available in any case;
c) Decision makers should be cautious when information is uncertain, unreliable, or inadequate; and
d) *The absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act."*

Thus, there are clear long-term objectives that guide decision-making, consistent with Components 1 and 2 and the precautionary approach is explicit within management policy.

PI SCORE	LOW RISK

3B: Fishery Specific Management System

CRITERIA: (i) The fishery specific management system has clear, specific objectives designed to achieve the outcomes expressed by Components 1 and 2.

(a) Objectives MEDIUM RISK

While objectives broadly consistent with Components 1 and 2 are specified in the Act and Fisheries 2030, and are therefore implicit in the fishery specific management system, it is not clear that explicit short and long term objectives for inshore trawl fisheries are in place at this stage. Accordingly, we have scored this SI medium risk.

CRITERIA: (ii) The fishery specific management system includes effective decision making processes that result in measures and strategies to achieve the objectives and has an appropriate approach to actual disputes in the fishery.

(a) Decision making LOW RISK

Sections 10, 11, and 12 of the Fisheries Act establish the requirements for the decision-making process, and Section 10 further requires the use of best available information for all decisions. This results in measures and strategies to achieve the fishery-specific objectives. The Fisheries Act requirement for best available information leads to scientific evaluation in advance of decisions. The Fisheries Act further requires consultation with such persons or organisations as the Minister considers are representative of those classes of persons having an interest in the stock or the effects of fishing on the aquatic environment in the area concerned including Maori, environmental, commercial, and recreational interests.

The MPI ensures that the Minister is provided with analysed alternatives for consideration before making any decisions (information is both from within and outside the Ministry [stakeholders, science]). The feedback process is formalised, involving planning, consultation, project development, and scientific enquiry. The Initial Position Paper/Final Advice Paper process highlights the extent of consultation, engagement and transparency of the decision making process. Thus, decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

(b) Use of the Precautionary approach LOW RISK

The precautionary approach must be followed by MPI. Section 10 of the Fisheries Act Information principles states: "*All persons exercising or performing functions, duties, or powers under this Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account the following information principles:*

a) Decisions should be based on the best available information:
b) Decision makers should consider any uncertainty in the information available in any case:
c) Decision makers should be cautious when information is uncertain, unreliable, or inadequate:
d) *The absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act*."

(c) Accountability and Transparency LOW RISK

Information on the fishery's performance is produced annually through the MPI Fisheries Assessment Plenary process and is available on the MPI website. Scientific and other research reports commissioned by MPI are also available on the Ministry website. Information on proposed management changes are published through Initial Position Paper which allow for stakeholders to comment. MPI's Final Advice Paper to the Minister is also publicly available together with a summary of submissions and alternative policy options. Feedback on any actions or lack of action is provided to stakeholders through a variety of forums, as well as directly through published decision letters of the Minister (e.g. Guy, 2015).

Disclosure of information can be requested from the Ministry, under the Official Information Act. Information is released except when it is decreed by the Minister to be commercially sensitive or breaches confidentiality between the parties.

CRITERIA: (iii) Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.

(a) MCS Implementation LOW RISK

MPI operates a comprehensive monitoring control and surveillance system including:

- fishing permit requirements;
- fishing permit and fishing vessel registers;
- vessel and gear marking requirements;
- fishing gear and method restrictions;
- vessel inspections;
- control of landings (e.g. requirement to land only to licensed fish receivers);
- auditing of licensed fish receivers;
- monitored unloads of fish;

- information management and intelligence analysis;
- analysis of catch and effort reporting and comparison with landing and trade data to confirm accuracy;
- boarding and inspection by fishery officers at sea; and
- aerial and surface surveillance.

In addition, MPI has a fishery outreach programme of informed and assisted compliance, in which enforcement agents work with the industry in a proactive way to ensure understanding of regulations and to prevent infractions (Ackroyd and McLoughlin, 2017). In combination with at-sea and air surveillance supported by the New Zealand joint forces, vessel activity can be monitored and verified to ensure compliance with regulations and with industry-agreed codes of practice.

While statistics on the blue cod fishery specifically were not found, it is clear that the MPI MCS system has demonstrated an ability to enforce relevant management measures. For example, Heron (2016) reports that MPI undertakes about 300 fishing related prosecutions per year with (ordinarily) over 80% or more resulting in convictions.

(b) Sanctions and Compliance MEDIUM RISK

For offences against the Fisheries Act 1996 or any of the Fisheries Regulations, the offender has to satisfy a reverse onus and establish that the offence was outside their control, that they took reasonable precautions and exercised due diligence to avoid the contravention, and, where applicable, they returned fish that was unlawfully taken and complied with all recording and reporting requirements. A wide range of sanctions from fines ($250 to 500,000) and imprisonment, forfeiture of catch and potential forfeiture of vessel, to prohibition from participating in fishing in the future constitute an effective deterrent to offenses and lead to industry compliance.

To meet the medium risk SG against this SI, sanctions to deal with non-compliance must exist and fishers must be generally thought to comply with the management system, including providing information of importance to the effective management of the fishery. The low risk SG requires some evidence to demonstrate fishers comply with the management system. In the first instance, it is clear that sanctions to deal with non-compliance exist for a range of offences, and these sanctions are regularly applied by MPI (e.g. Heron, 2016). It is also true that fishers are required by law to submit a range of information of importance to the management of the fishery (e.g. catch-effort returns, which are cross-checked against returns from Licensed Fish Receivers (LFRs). While there is no specific information available on compliance rates in the inshore trawl or purse seine sectors, there is some evidence that fishers are generally compliant with the management system. For example, MPI (2016b) reports that rates of compliance generally amongst the commercial and recreational sectors in the 2015/6 year were 89% and 94% respectively (Table 6). Moreover, Kazmierow et al (2010) concluded there were likely to be relatively high levels of compliance based on interviews with fishers in the South East fin fish fishery. Accordingly, we have scored the fishery medium risk.

Table 6: Compliances rates amongst New Zealand fisheries (from MPI, 2016b).

SERVICE PERFORMANCE MEASURE	ACTUAL 2015/16	STANDARD 2015/16	VARIANCE
Percentage of commercial operators inspected found to be voluntarily compliant	89%	90%	-1%
Percentage of recreational fishers inspected found to be voluntarily compliant	94%	95%	-1%
Percentage of serious offenders do not reoffend within the next year	96%	95%	1%
Percentage of complex investigations completed within legislative requirements	98%	100%	-2%
Percentage of non-complex investigations completed within six months	92%	100%	-8%

Nevertheless, we note there has been considerable debate in recent years about the adequacy of the MPI compliance system, and in particular its response to alleged dumping of QMS species (e.g. Simmons et al, 2016; Heron, 2016). Email correspondence quoted by Heron (2016) suggests there has been a view internally amongst MPI that discarding has been a more general problem amongst inshore fisheries harvesting a diverse mix of species. The fishery would be better placed against this scoring issue if evidence of strong compliance with all laws was available.

(c) Systematic non-compliance

Limited evidence is available in the extent of compliance specifically in the inshore trawl fisheries.

CRITERIA: (iv) There is a system for monitoring and evaluating the performance of the fishery specific management system against its objectives.
There is effective and timely review of the fishery specific management system.

(a) Evaluation coverage LOW RISK

The Fisheries Working Group process and annual Plenary reporting provide mechanisms to evaluate key parts of the management system (e.g. stock assessments; biomass against reference points). Where changes are required to sustainability measures, IPPs/FAPs are prepared to evaluate and present alternative management options. Processes for review are also built into policy and regulatory documents (e.g. NPOAs).

(b) Internal and/or external review	LOW RISK
The fishery management system is subject to regular internal review through the fisheries Plenary reporting process. The Ministry implements a comprehensive peer-review process for all science research that is used to inform fisheries management decisions.	
PI SCORE	**LOW RISK**

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